PLASTICS

A Periodical Devoted to the Manufacture and Use of Composition Products

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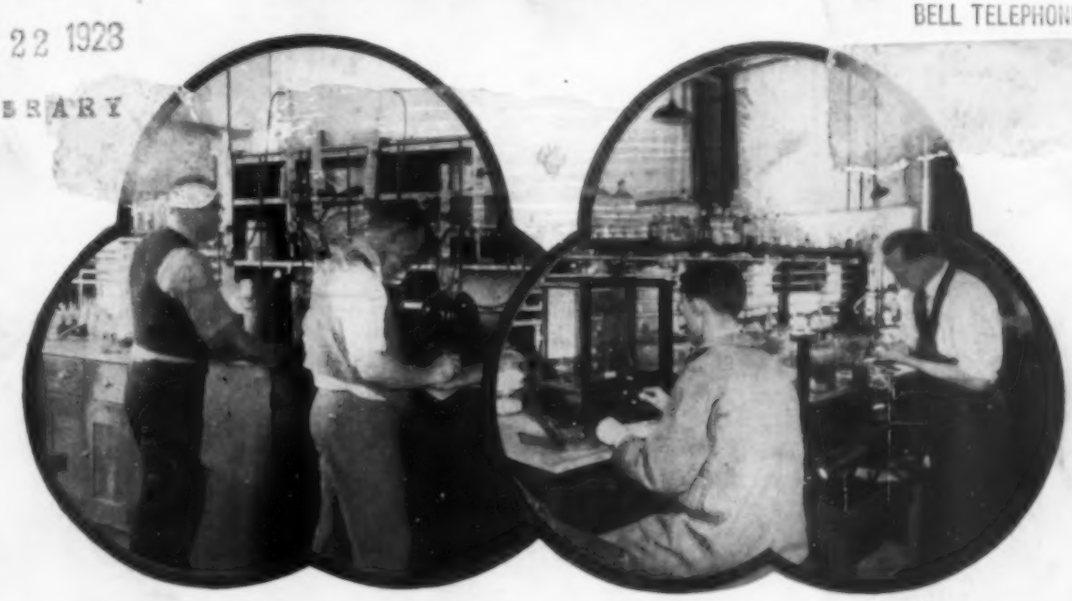

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Molded Products

See Page 687

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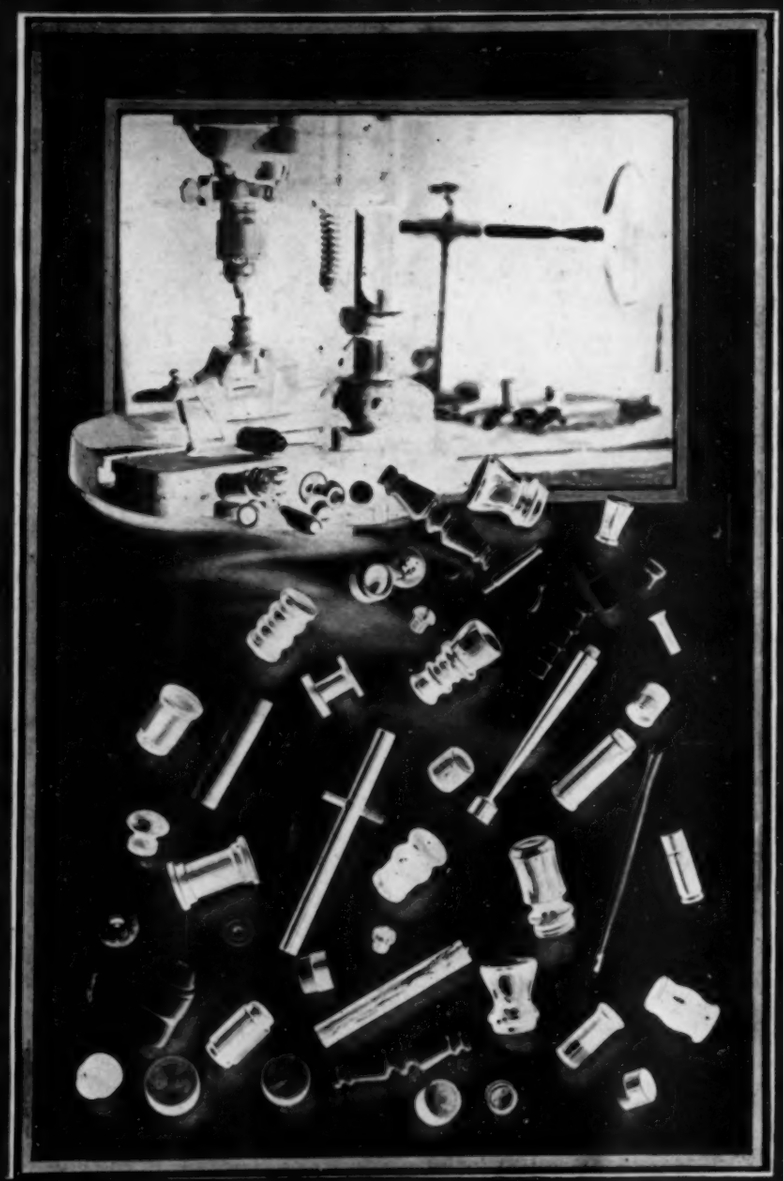

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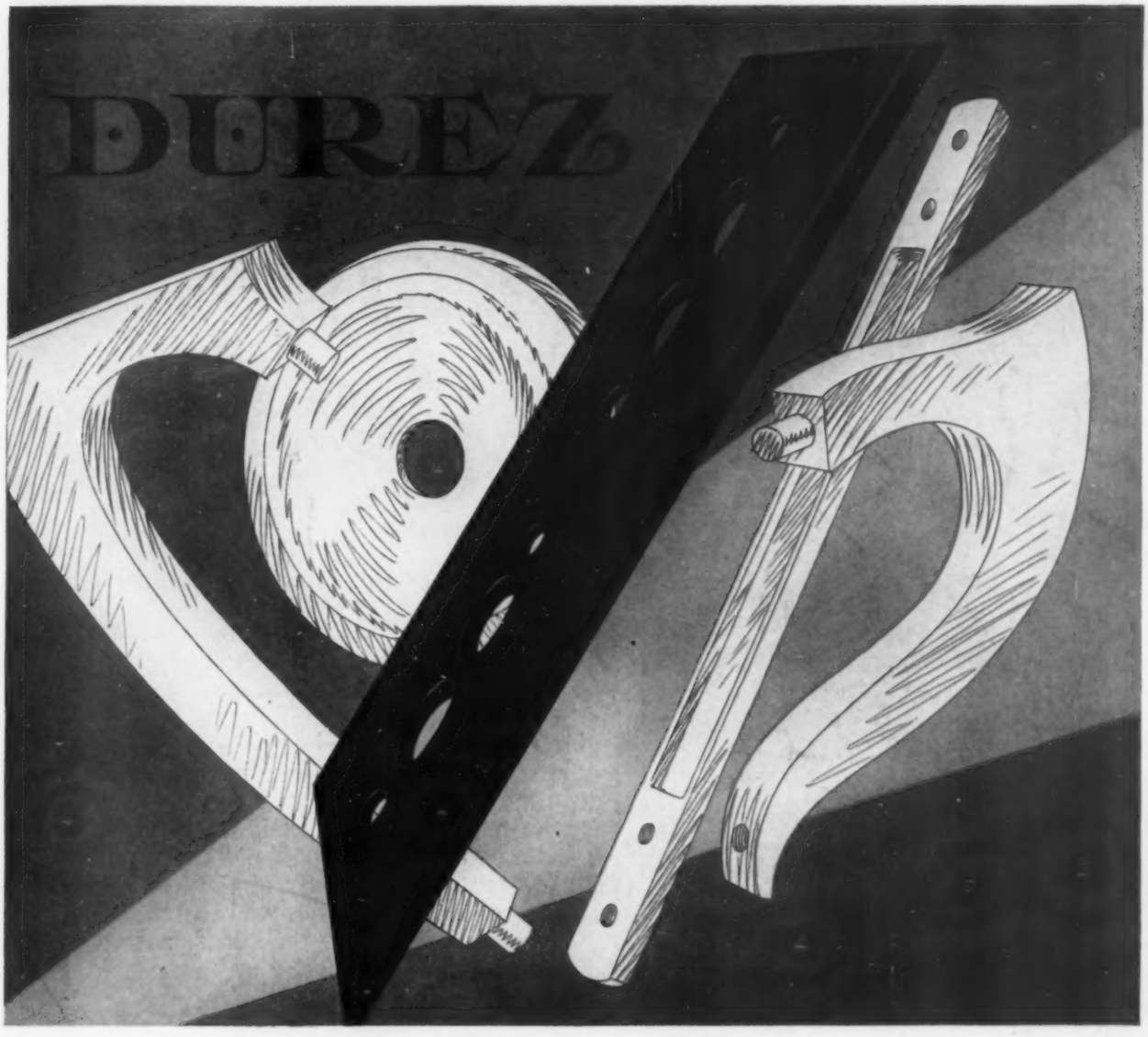

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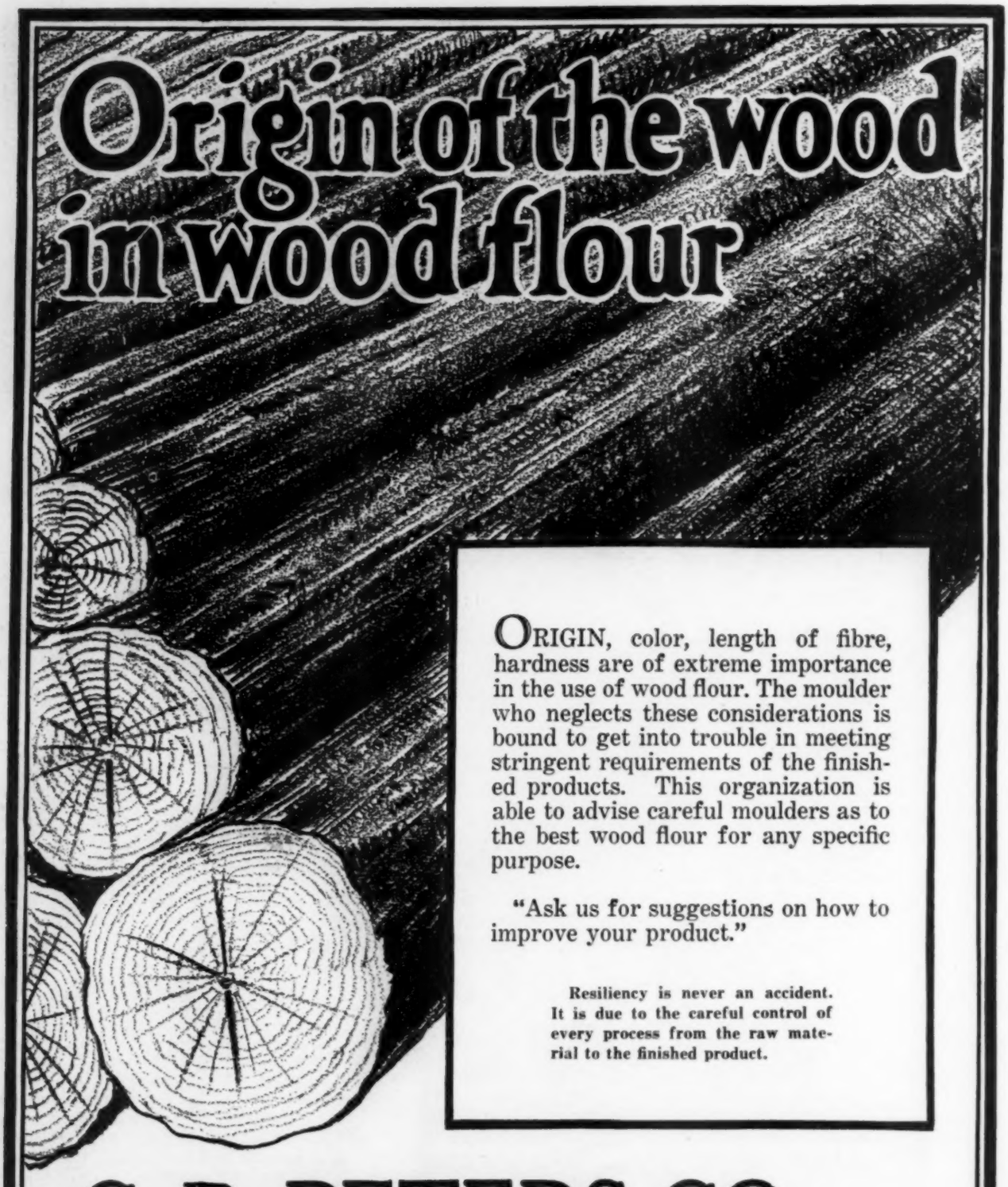

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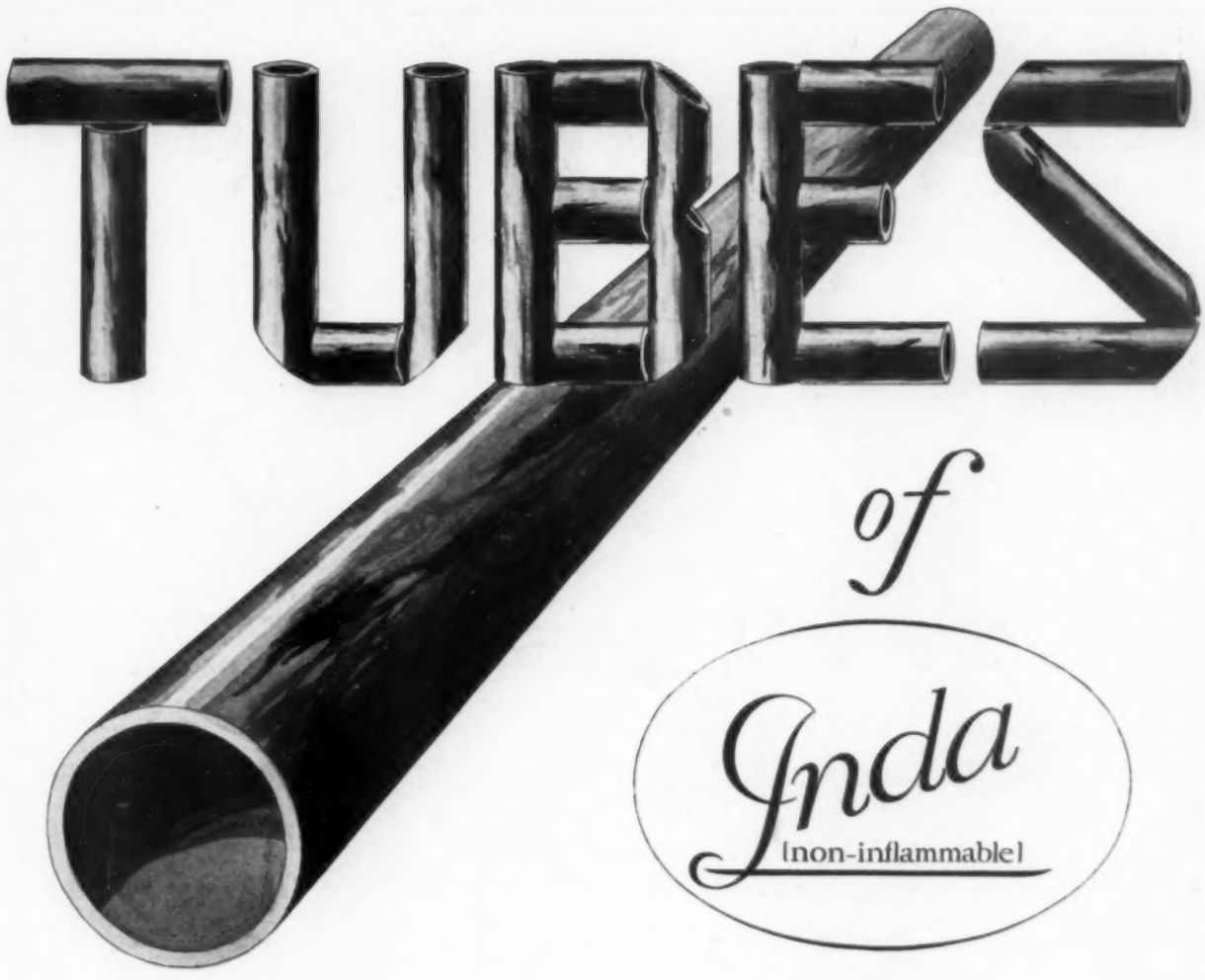

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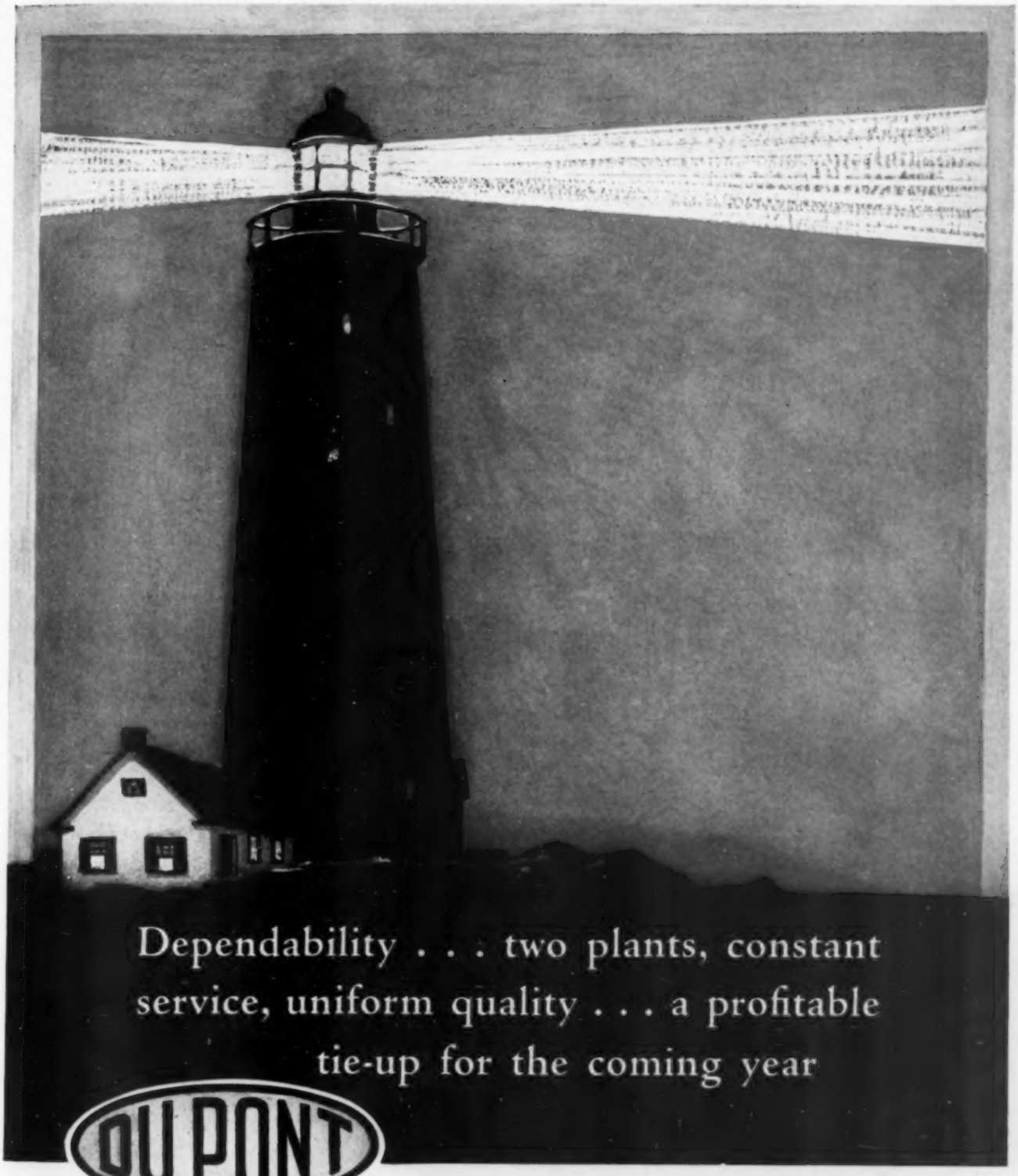

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PLASTICS
& MOLDED PRODUCTS

A periodical devoted to the manufacture and use of plastic and composition products

Vol. 3 DECEMBER, 1927 No. 12

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Carl Marx, B. Ch., Editor
A. Moses, B. Sc., A. I. C., Associate Editor
William Gruen, E. E., A. M., Associate Editor V. C. Rockhill, Consulting Editor
A. C. Blackall, British Correspondent Heinrich Prehn, German Correspondent
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PLASTICS

A periodical devoted to the manufacture and use of plastic and composition products

Vol. 3 DECEMBER, 1927 No. 12

Manufacture of Pyroxylin from Wood Pulp

Cheaper raw material for the production of plastics would result from replacement of paper and cotton as raw material in this field

MOST of the pyroxylin (cellulose nitrate) used in the production of the pyroxylin plastics has been made from paper; or from cotton. During the World War, many attempts, some quite successful, were made in Germany for producing cellulose nitrate from wood pulp. While mostly restricted to explosives, the further development of the process for the lower nitrated cellulose suitable for plastics followed.

Process Used

Victor Planchon patented a process for the production of a pyroxylin suitable for plastics on Sept. 6, 1927, U. S. P. 1,641,-292, which covers the following subject matter; and will undoubtedly prove interesting to all those who are following the development of the zyl plastics; as the cost of raw material must be reduced to meet modern competition. The patent says:

Nitrated cellulose is obtained, in practice, by using cotton or thin paper treated according to the well-known nitration process. Attempts have been made to substitute for cotton a less expensive raw material such, for instance, as wood pulp in sheets for example, but such attempts have hitherto proved fruitless and it is generally known that wood pulp is practically incapable of being nitrated by the known methods owing to the fact that the sheets of wood pulp are hydrolyzed and partly dissolved long before the nitration is completed.

Paper and cotton are the usual sources of cellulose for the preparation of the cellulose esters, the former being thus far the most useful of the two for the pyroxylin needed for plastics.

Wood pulp has long been the source of cellulose for Rayon manufacture by the Viscose process.

During the war, Germany successfully made explosive guncotton from wood pulp. If the present method for making the lower nitrated cellulose succeeds, it will lower the cost of raw material for the celluloid type of plastics.

In the present invention, only wood pulp in sheets is used to obtain nitrated cellulose.

The invention is characterized by the following points:

1. The usual nitration bath a mixture of nitric acid and sulphuric acid) is used at a temperature always below 15° C., and the sheets of wood pulp are immersed in the aforesaid bath for a sufficient period which depends on the temperature of such bath and which, consequently varies with it.

2. A method of manufacture is used which is peculiar to the employment of wood pulp sheets for obtaining nitrated cellulose and which is altogether unsuitable for the ordinary manufacture of nitrated cellulose from cotton, waste from spinning thin paper, etc.

Commercial Pulp Used

The wood pulp sheets suitable for the manufacture are those which are found in commerce in the well-known form of thick sheets similar to blotting paper and used in the manufacture of viscose. These sheets, of the size current in trade, are, first, placed in grooves of a support constructed of acid proof metal, such as aluminum, and capable of being immersed with its contents in a vat filled with acids which compose the nitration bath.

The grooves of the support, which is similar to that used for the vertical washing of

photographic plates, are brought sufficiently close to one another to leave between the sheets a space of a few millimeters only. A support of this character is illustrated in Fig. 1, and is generally designated 1, the grooves or seats 2 being formed in its upper and lower horizontal members 3 and 4. The pulp sheets are designated 5 and the vat is designated 6.

The sheets of pulp may alternatively be perforated at selected points of their surface as indicated at 7 in Fig. 2, and be placed in juxtaposition, strung one after another on glass rods 8 so that they may be separated by small spaces, as shown.

Nitration

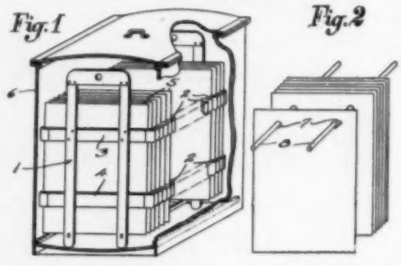
The unit made up in one or the other of the two ways mentioned may consist of any number of sheets—for instance, 50 sheets weighing 100 grams each—and the nitration is effected afterwards simultaneously in the same vat on several units of this description, say 6 for example, representing 30 kilograms of pulp which after nitration will yield, on an average, 50 kilograms of nitrocellulose.

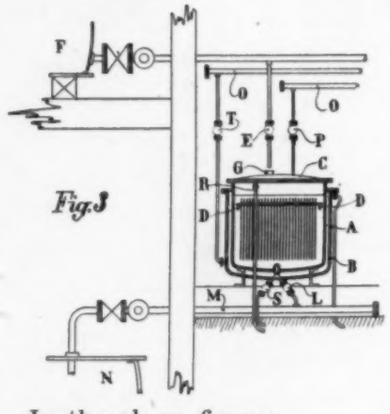
The immersion vats 6 may be made of any resisting metal but, as it is most important, from a hygienic point of view, to operate in closed vessels and therefore to carry out the first washing operations in the actual vat where the nitration takes place, preference is given to aluminum which is very resistant to acids either concentrated or diluted with water. The shape and dimensions of these vats may vary, as may also the method of suspending the sheets.

Equipment

By way of example, a construction suitable for industrial manufacturing is represented in Fig. 3 which shows a rectangular vat A surrounded by a jacket B, through which a current of water at a constant temperature is continuously circulating, the vat having its top part closed by a light and close-fitting cover C of the same metal.

When this vat is empty and the cover raised, the free ends of the rods carrying the units are deposited on cross bars D D, the cover is fitted on, and the different valves with which the vat is externally provided permit the nitration and the first washings being carried out hermetically. For this purpose, the valve E which regulates the influx of the nitrifying mixture supplied by the upper tank F,





In the above figures

Figure 1 is a perspective view with parts broken away, of a vat containing a support for the wood pulp sheets to be nitrated.

Fig. 2 is a perspective view of another device for maintaining the sheets a few millimeters apart in the bath.

Fig. 3 shows diagrammatically an apparatus for carrying out the process.

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is opened. The liquid rises from the bottom of the vat and fills it to the level necessary to entirely immerse the pulp sheets; such level being reached when it is observed from outside that the intermediate funnel G begins to be filled. At that moment valve E is closed and the nitration proceeds.

During nitration, the circulation of the water is maintained in the jacket B. The temperature of the refrigerating water should only vary within very narrow limits (1 or 2 degrees, for instance); it must not appreciably exceed 15° C. This condition, which is indispensable to insure the success of the operation, is easily realized by employing an intermediate vat in which the spring and well water etc., used may be cooled by a circulation of brine obtained from any refrigerating apparatus or the like.

The nitration is thus carried on at a constant temperature without any need to raise the cover of the vat, but its duration cannot be predetermined because it depends upon the composition and temperature of the nitration bath employed.

Bath Used

It is known that the nitrocellulose obtained has a substantially-constant percentage of nitrogen when the bath used is itself constant. This is why, in order to prepare the variety of soluble nitrocellulose called "collodion quality" with 10 or 10.5% of nitrogen, the nitration bath must for instance, contain:

H_2SO_4	62%
HNO_3	20%
H_2O	18%

If a bath of this description is used, the total nitation of the wood pulp will require about 12 hours if the operation is carried on at a temperature of 15° C., and about 20 hours at 10-11°.

With these temperatures, the nitration proceeds gradually and smoothly. It may be checked by testing specimen sheets taken, say, every hour. The percentage of nitrogen and the increase in weight of said sheets may be expressed by curves. Such curves are regular and at the end of the period above-mentioned they become asymptotic, showing that the maximum of nitration has been reached.

Time Not Important

A longer treatment, even extending to many hours, does not appreciably alter either the percentage of nitrogen or the weight of the nitrated product.

(*Continued on page 678*)

Phenol, Rubber and Formaldehyde

New combination forms a source of molding powders that combine some of the good qualities of hard rubber and the phenol resins

LITTLE did Goodyear, the inventor of the vulcanization of rubber, and the father of the hard-rubber industry dream that other materials would in the years to come threaten the supremacy of hard rubber.

The phenol plastics did, however, seriously, cut into the hard rubber industry. But the chemists in the rubber plants were on the job, and a constant stream of patents on new rubber products that can be handled like the phenol plastics, is the result. What their future will be remains to be seen; but they bear watching on the part of those with whose products they may compete.

THE old-time hard rubber plastics and the phenol resins, which have been friendly competitors in the field of molded products, now appear to have become wedded indeed. Only recently combinations of rubber and casein have been described in our pages, and now we learn, from some very recently issued patents, that rubber, phenol and formaldehyde can be condensed to form products that lend themselves readily to ordinary molding operations.

The process is described by John McGavack in two patents issued August 30, 1927, U. S. P. 1,640,363 and 1,640,364; both assigned to the Revere Rubber Co., of Chelsea, Mass.

Rubber and Formaldehyde

The invention comprises a process for making rubber combinations which includes causing a reaction to occur between rubber, preferably in the form of a solution, an aldehyde, and a phenol if desired, and a condensing agent, and recovering the reaction product formed; and the excess of reagents.

The term "solution" as herein employed is intended to include rubber dissolved in an organic solvent such as carbon tetrachloride, chloroform, benzol, etc., as well as rubber latex or other water emulsion of rubber with or without admixture of an organic solvent such as carbon tetrachloride, etc.

Example 1

The following procedure represents one embodiment of the invention: 15 kg. of pale crepe are dissolved in 300 kg. of carbon tetrachloride. 25 kg. of concentrated sulphuric acid (specific gravity 1.84), which acts as a condensing agent, are added to this mass and intimately mixed. To the mixture is added 40 kg. of a 40% solution of formaldehyde. The materials so mixed are placed in a vessel under reflux condenser and heated at 100° C. for from 2 to 3 hrs. The resulting mass is a grayish white product. It contains free acid, formaldehyde and carbon tetrachloride. 100 kg. of water are now added to the mass and carbon tetrachloride is removed by distillation. Approximately 90% of the carbon tetrachloride may be recovered in this way. The mass is then washed in running water to free it completely from free acid. The product is then dried in any convenient manner. It is first milled on the cold mill The milled mass is subsequently heated at approximately 95° C. until dry. The product is a brownish black powder which is molded at 140-160° C. The material will take a high polish, and may be machined, turned, sawed or drilled.

Molding

The material so obtained molded under 3000 to 4000 lbs. per square inch has a specific gravity of approximately 1.05 at approximately 18° C., has a softening point of 130° C., a transverse tensile strength of approximately 400 lbs. per square inch, and is practically insoluble in all acids and bases as well as organic solvents. It is opaque, and is useful as an electric insulating material, its brittleness approximating that of hard rubber.

A Definite Compound

It has been definitely proved that the brownish black powder is a definite chemical compound and not a mixture of the various components involved. This has been proved by varying the proportions of the ingredients employed in forming the substance within a sufficient range to show an appreciable variation in the carbon, hydrogen, oxygen and sulphur content of the mass in case simply a mixture were present. The analysis in all cases of the resulting prod-

uct has been as follows:—carbon approximately 64.8, hydrogen 8.8, oxygen 22, sulphur 1.5.

Instead of carrying out the procedure in a reflux condenser the mixture of dissolved rubber, sulphuric acid and formaldehyde may be placed in a pressure bomb and heated to 140° C. for 30 to 60 minutes, at the end of which time the brownish black powder obtained as above is secured.

Example 2

Instead of formaldehyde as mentioned in the above example there may be substituted 15 kg. of butyl aldehyde or 15 kg. of furfural. The mixture including butyl aldehyde or furfural is placed in a container and heated to 100° C. for 2 to 3 hrs. The material is washed and dried as indicated in the above example and in each instance where butyl aldehyde or furfural is employed produces a product having similar properties to that produced in accordance with Example 1, except that the materials according to the present example have slightly lower softening points than those prepared from the formaldehyde.

Example 3

As another example of the procedure 15 kg. of rubber are dissolved in 300 kg. of carbon tetrachloride to which is added 25 kg. of sulphuric acid, 40 kg. of a 40% solution of formaldehyde in which is dissolved 15 kg. of phenol (carbolic acid) is added to this mixture. The whole mixture is then placed in a vessel provided with a reflux condenser and heated at approximately 100° C. for 2 to 3 hrs. The resulting product is then washed in 100 kg. of water, milled and dried as above. The resulting material is reddish brown. It is molded under 3000 to 4000 lbs. per square inch pressure at 150-170° C. Its general physical properties resemble those of the materials produced in Example 1 above. The material appears to be made up of a homogeneous mixture of the material made in accordance with Example 1 and a condensation product of phenol and formaldehyde.

Example 4

As another example of the process 15 kg. of water are dissolved in 300 kg. of carbon tetrachloride and to this is added 15 kg. of butyl aldehyde and 15 kg. of phenol. 10 kg. of concentrated sulphuric acid are now added and the mass is refluxed and heated for 2 to 3 hrs. at 100° C. The black viscous liquid obtained is treated with 100 kg. of water as above and distilled to remove the carbon tetrachloride and excess butyl aldehyde. The mass is then washed, milled and dried as indicated in Example 1 to from a black resinous material which resembles the products produced by the process in Example 3 above but is somewhat more brittle.

Example 5.

As another example of the process, to 100 kg. of latex is added 650 kg. of carbon tetrachloride and the mixture is shaken until a smooth emulsion is formed. To this is added 30 kg. of phenol and 80 kg. of a 40% formaldehyde solution. These constituents are thoroughly mixed and 40 kg. of concentrated sulphuric acid are then introduced. These constituents are placed in a vessel provided with a reflux condenser and heated to 100° C. for from 2 to 3 hrs. The resultant product is washed and dried as indicated in the example above, and may then be molded into a plastic mass. The mater-

(*Continued on page 678*)

Fordite Steering Wheels

IN the April issue of 1926 PLASTICS there was given an alphabetical list of Plastic Materials, together with a short resume of their composition, origin, etc. Among these was a material known as "FORDITE" which was the substance of which the molded steering wheels of the Ford car were made.

Millions In Use

The same material, slightly modified in composition, also formed the basis of the battery boxes, battery covers and similar molded parts of the Model T Ford car. Nothing beyond the fact that the material was some form of molded product, comprising rubber and reclaimed rubber was known at the time being in the Patent Office. Since 1920, a patent has just issued on this product, which is the invention of Clarence W. Avery, at that time superintendent of the Highland Park plant of the Ford Motor Co., and Dan O. Moody, a free-lance experimenter in the employ of the organization. Mr. Moody, however, died in 1923 as the result of a collision between his automobile and a railroad train.

Many million of these Fordite steering wheels have been made, and the material was remarkable for its strength and toughness. It is not yet known as to whether the new Ford will likewise contain this product. According to the patent (U. S. P. 1,642,666) the wheels consist of a core having a composition as follows:

	Per cent by weight
Pale crepe (Hevea rubber)	11.45
Brown crepe (Hevea rubber)	7.60
Reclaimed rubber	14.25
Bitumen for rubber compounding	18.10
Hydrated lime	4.80
Sulphur	6.20
Ground straw and excelsior	30.00
Inert filler for rubber compounding	7.60

The cover, which was wrapped around the core and the two then vulcanized together, has the following formula:

Smoked sheet (Hevea rubber)	27.05
Reclaimed rubber	3.75
Bitumen for rubber compounding	12.30
Ground waste rubber	7.50
Hydrated lime	2.45
Litharge	4.65
Sulphur	10.70
Inert filler for rubber compounding	6.65
Lead oleate	0.65
Ground asbestos	23.65
Carbon black	0.65

It is quite evident therefore, that the Fordite is to be classed among the hard-rubber type of plastics.

An Albumenoid Glass Substitute

A molded product made from gelatin combines nonbreakability with artistic possibilities.

ALFRED Eggiman and Albino Perea, of Paris, France, describe a molded product made essentially from gelatin. (U. S. P. 1,644,115; Oct. 4, 1927). It is adapted to replace glass for a great number of purposes, especially for purposes of illumination.

They state that the product can be colored uniformly throughout its mass with a single tint or it may be provided with veins that give it the appearance of alabaster.

The surface may be varnished to prevent damage by moisture. As the new product can be given any required shape, its applications are numerous and it may be utilized for making shades, cups, saucers, basins and the like. The product is noninflammable, unbreakable and translucent to almost clear.

Gelatin Used

The preferred method of manufacture comprises the preparation of a solution of 500 grams of a special gelatin in 2500 grams of water, 250 grams of zinc white being likewise added.

These ingredients are mixed together in a receptacle which is by preference formed as a sand stone basin. The operation is conducted under heat in a water tray or bath, at a temperature of about 45° C. The mass is continually agitated, this agitation being effected by means of a wooden rod until all the ingredients are fused and the solution takes the form of a homogeneous mass of slightly viscous nature.

This solution is then poured into another receptacle or stone basin, being filtered through a very fine gauze sieve so as to remove impurities and lumps which may be contained in the primary solution. In this way the constitutional substance or material of the new product is produced.

Gelatin is an albumenoid substance prepared by hydrolysis of the collagen present in de-limed bones, hides and the like.

In its purest form, it is edible, the lower grades being employed in the arts, the less viscous types forming common glue.

Its applications are very wide, and its use for plastics is not entirely new. It has certain similarities to casein, and can be hardened by formaldehyde.

In order to manufacture an article therefrom a mould is provided having, on the outside, the shape of the said article. The mould is preferably of metal and may for instance be made of aluminum. It is dipped into the solution which has been prepared so that the whole outer surface is submerged. It is then removed from the bath and owing to the viscosity of the solution it adheres and covers the surface of the mould to a certain thickness.

When the mould is removed from the bath, the excess of solution is allowed to drain away for a short time and then the mould is so manipulated that the layer which adheres thereto spreads in a homogeneous manner over the whole surface of the mould. It is then allowed to cool, and the solution solidifies the article thus manufactured remaining upon the mould. It is afterwards allowed to dry for a day.

After the drying is finished, the colouring of the article is proceeded with, so as to give it either a uniform surface or to form veins where it is desired that it shall have the appearance of alabaster.

With this object in view, there is first prepared in a suitable receptacle a solution constituted as follows:—

Veining and Coloring

2,500 grammes of water, 500 grammes of pure gelatin.

In order to melt the gelatin the operation is carried out in the water bath at a temperature of 45° C. whilst continuously stirring. The solution obtained is filtered through a very fine gauze, which removes impurities and lumps.

To provide veins of a certain color upon the article or veins of various colors, pure gelatin is first dropped in various places over the surface of the solution together with some drops of aniline colours. Then the mould carrying the article which is dry, as manufactured by the first process is taken and dipped sharply into the gelatin solution and zinc white. It is withdrawn and immediately dipped into pure gelatin solution having on its surface the drops of aniline colour. The colours penetrate into the mass of the article in the form of veins, the shapes of which are evidently absolutely arbitrary, depending upon the distribution of the drops of colouring matter over the surface of the gelatin.

The article is then dried at a temperature of 20° C. and when perfectly dry it is removed from the mould.

After it is absolutely dry the

(*Continued on page 681*)

Pyroxylin Used in Imitation Gold Leaf

The decorative leaf used in stamping on plastics can be improved by use of cellulose nitrate which lends to it greater durability and non-tarnishing properties

By Carl Marx

IN connection with the article by A. Jaeckel, on page 595 of the November issue of PLASTICS, the use of pyroxylin itself in the roll gold and gold leaf preparations used for printing upon celluloid, etc., may be news to some of our readers.

Dutch Metal

The original attempts to employ substitutes for the expensive and inconvenient gold leaf were aimed at producing an imitation of the original material. Alloys having the color of gold, and approximately the same ductility, were beaten into thin films, very much in the same way as real gold leaf is made. This material was generally known as "Dutch Metal." While the stampings produced by it were satisfactory when new, the metal soon oxidized and became green. This was due to the fact that copper formed a large part of the metal foil, which, in fact, was a sort of bronze or brass.

Imitations

About twenty-five years ago the first efforts to form a gold leaf material out of bronze powder were made. Bronze powder was mixed with pyroxylin solutions and applied to smooth surfaces, either by brushing, dipping or spraying, and allowed to dry. The coatings thus formed were afterwards stripped from their support and employed like regular gold leaf. This made the use of the material not one whit simpler than before, but did supply a leaf that had better keeping qualities than Dutch Metal, as the bronze powder particles were each imbedded in an individual sheath of pyroxylin lacquer.

About 1908 a plant in the United States began making a very successful form of gold leaf imitation based on the spraying of pyroxylin lacquer in which bronze powder was suspended. These sheets were also given a coating of an adhesive on the side which was intended to adhere to the base being printed upon. The size employed for this purpose consisted essentially of shellac, with a softening agent to prevent too great brittleness.

The leaf was sold interleaved with tissue paper just like regular gold leaf, and had no paper support; so that its handling was about as difficult as the real material. By reason of its superior lasting qualities however, the material became very popular, and most of the gold stampings on the backs of books, celluloid and other plastic articles, were made from this pyroxylin imbedded bronze powder.

Roll Leaf

About 1912 a material came on the market in the form of a glassine paper ribbon having a composition on its surface that would release bronze powder and impress material placed beneath it when the reverse of the paper support were struck by a heated die. This roll gold immediately became quite popular, and for the cheaper grades of work soon completely superseded the individual sheets of imitation gold leaf. The base in which the bronze powder was imbedded in this kind of roll leaf was a form of wax, usually carnauba, beeswax and the like, with additions of suitable resins to increase its adhesiveness. While the impression produced was satisfactory in appearance, the lasting qualities of the printing were poor, as the wax did not protect the bronze powder against oxidation and tarnishing.

During the war a better form of this material was developed, and about four years ago was first introduced to the American market.

In its final developed form, this imitation roll leaf consisted of pyroxylin imbedded bronze powder supported by a web of glassine paper which had been given a coating of a composition which would release the bronze powder when heated. The outer surface of the leaf, that is to say the side which would contact with the support being printed upon, and cause the adherence of the bronze, was given a coating of a material which would become adhesive when heated. Shellac formed the basis of this adhesive, as it is plastic, will mold accurately, and hence form clean cut and permanent impressions.

A great deal of experimental work was necessary to find the proper balance between the brittleness of the bronze leaf proper, the flow property of the wax which held it to the paper support, and the adhesiveness of the shellac which caused it to adhere to the printed surface. The equipment used for producing this roll gold leaf had to be developed as well, and all the coating was eventually done by means of air spray. Much of the development was along lines quite similar to those followed in the perfection of the modern "Duco" finishes, and low viscosity pyroxylins were especially developed for the purpose.

Heated Cutting Knives for Plastics

Apparatus for producing thin cut sheets of cellulose ester plastics employs steel knives heated by electrical induction to speed production.

THE inherent difficulty in cutting sheets of cellulose ester plastics, such as the pyroxylin plastics and especially the cellulose acetate plastics from large blocks of solidified material low in solvent, has been rather neatly solved by Frederick T. Small and William A. Dickie of Spondon, England.

Their invention, covered by U. S. P. 1,637,715; Aug. 2, 1927, and assigned to the Celanese Corporation of America, minutely describes an apparatus for shaving or cutting thin sheets of cellulose acetate plastic from a block of the material, by using a heated knife for the purpose, so that the plastic will be softened and more easily cut.

Heating By Induction

The knife and surrounding parts of the machine are heated by electrical induction, so that danger from fire is avoided.

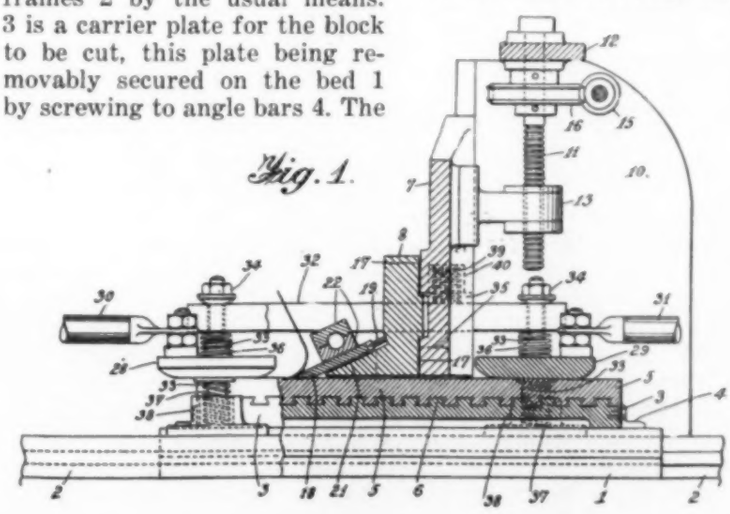
Figure 1 shows a sectional elevation of the apparatus employed by the inventors.

1 represents the usual bed or table of the machine which is reciprocated on gibs of the side frames 2 by the usual means. 3 is a carrier plate for the block to be cut, this plate being removably secured on the bed 1 by screwing to angle bars 4. The block 5 to be cut is keyed on the carrier plate 3 by dovetail grooves as shown at 6.

7 is transverse frame or knife carriage that carries the knife carrier block 8, this frame or bridge being vertically adjustable in guides or gibs 9 of side frames 10 by a micrometer screw 11 mounted in a transverse head plate 12 and working in the nut 13 of the bridge 7 and operated by a hand wheel.

8 is the knife carrier block, which is insulated from the knife carrier bridge 7 by an asbestos sheeting 17. 18 is the knife mounted on the knife carrier block 8 by adjusting screws 19 working in threaded holes 20 and serving for levelling the knife, 21 is an asbestos sheet fitted between knife 18 and knife carrier block 8. 22, 22 are two iron bars extending the width of the knife and making good metallic contact therewith, these bars each having a semicircular groove so that when secured together by the bolts 23, 24 they accommodate between them a length of thick copper cable 25, the bolts 24 screwing into the knife 18. A cable extends the width of the knife and has its ends connected to leads of an alternating circuit. A very low voltage alternating current is supplied to the knife heater cable, whereby the rapidly changing magnetic field due to the current in this cable heats the steel bar 22 in contact with the knife. This method is preferred as being safe from dangers of fires due to short circuits or fusing of resistances such as might occur with resistance heating, and temperatures up to about 200° C. can be maintained and readily controlled with such an arrangement. The heat from the electrical heater extending along the knife is transmitted to the cutting edge, i. e. the place of actual shearing of the material, thus rendering the material in contact with the edge more plastic and reducing the resistance to such an extent that the material can be readily cut.

Fig. 1.



Adjustable Knives

The height of the knife carrier above the bed of the machine can be varied by the micrometer screw 11 to adjust the depth of cut taken by the knife.

28, 29 are iron blocks or plates extending across the machine in front of and behind the knife respectively, and arranged to be heated electrically, preferably by electric induction heating, in a similar way to the knife. 30, 30 and 31, 31 indicate the electric leads therefor. These heating irons 28, 29 are mounted on side bearers or yoke bars 32, 32 in such connection with the knife carriage 7 that as the knife is lowered the heating

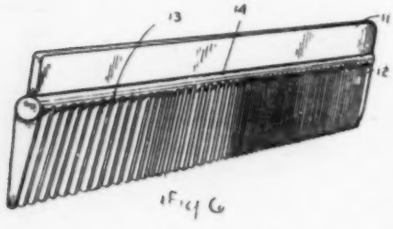
(*Continued on page 683*)

And Still They Come

Comb inventors vie with each other in this crowded field

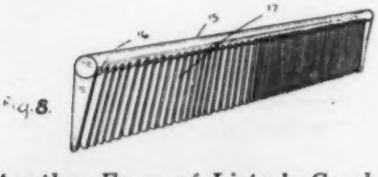
Whether they bob it or let it grow, the designers of combs for both men and women are ever seeking the ideal for the given purpose, and despite the fact that combs were found in Egyptian tombs, patents still issue on new ones.

ONE would almost believe that the antiquity of the comb would preclude any further developments sufficiently new to become the subject matter of patents; but apparently there is no limit to the ingenuity of the modern inventor.

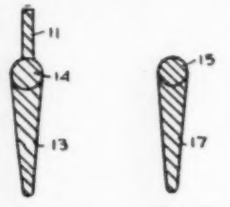


Lister's Comb

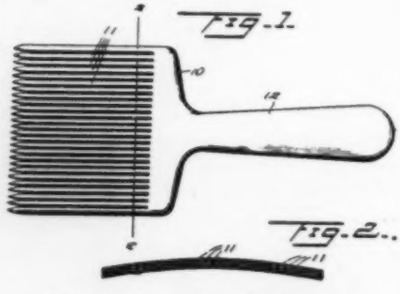
Within the space of little over a month, three further patents have issued in this field. The first one aims at the production of a comb that will not pull out the hair, and accomplishes this result by forming a smooth rounded surface between the teeth at the base of the same. The inventor, Herbert Lister, of Montreal, Que., in his U. S. P. 1,632,238; June 14, 1927, shows two different forms, as illustrated by the cuts of his figures 5, 6, 7 and 8, shown herewith. The back of the comb (11) extends into a running bar 14 from which the fine teeth 12 and the coarse teeth 13 project thereby forming between the teeth the rounded running surfaces 14. The comb may be made from any of the modern plastic materials, such as pyroxylin, casein solids, etc.



Another Form of Lister's Comb



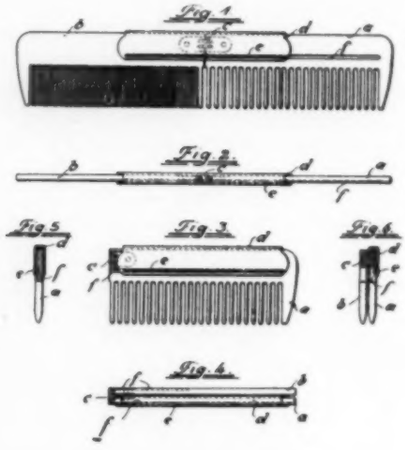
From the Pacific coast, Ralph N. Hymer, of Newberg, Oregon, brings the idea of a barber's comb that looks very much like a glorified whitewash brush, except that when viewed in cross-section the comb is slightly warped to conform to the general shape of the head. The patent, U. S. P. 1,633,893; June 28, 1927, says that the comb is especially useful for "shingling" women's hair. The material is bone, pyroxylin, casein, etc.



Ralph Hymer's "Shingling" Comb for Barbers

Folding Combs

Folding combs also engage the attention of inventors, and a new way of doing this is shown almost every month. The July contribution is by Heinrich Scholl, of Germany, who, in his U. S. P. 1,636,870; July 26, 1927, shows a folding comb in which the hinge is covered by a slide so that the hinge will not catch in the hair and tear it out. The comb has a double hinge at the joint between its two elements the hinge being sunk into the comb-back. The slide is long and ornamented and is guided by means of a guide rib in a groove cut into the surface of the comb back. The construction is practically self-evident from the figures which are reproduced herewith.



Scholl's Folding Comb

Double Comb

Mr. Fred Roberts, of Portland, Oregon, proposes still more novel a form of comb; as he describes it in his patent 1,627,408 issued last May.

His present invention is designed to provide in a single unitary structure two combs of different degrees of fineness and of sufficient length for barber's use, the combs being connected by a handle portion of convenient size, so that either comb may be readily positioned for use by a simple reversal on the part of the barber.

Two-in-one

In the use of the implement, the barber, with the teeth at one end in use, and desiring to use the teeth at the other end, will simply reverse the implement in his hand, without loss of time and without the necessity of selecting another comb. The barber has thus at his selection combs of different degrees of fineness at all times conveniently available, and either of which may be used by a simple reversal of the position of the comb.

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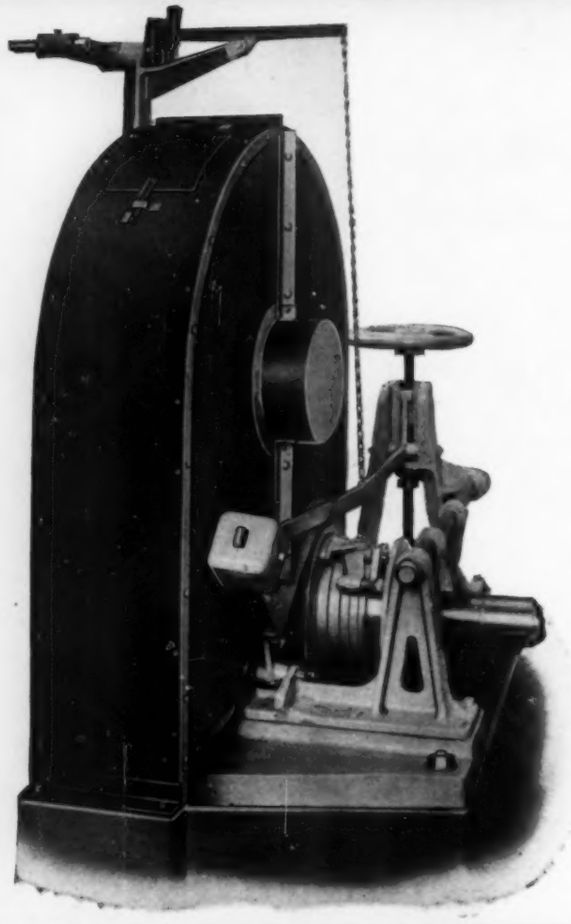

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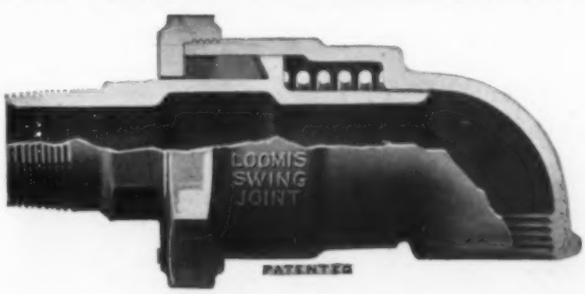

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The Most Recent Synthetic Resin Patents

Phenol resins that are kneadable like rubber dough, methylal resins; special types for cold molding, and urea formaldehyde aminoplastics receive attention

Compiled by Carl Marx

DURING September and October, 1927, a number of interesting patents on the production of synthetic resins issued.

The first one of these, U. S. P. 1,643,447; Sept. 27, 1927 is that of Edouard J. P. C. de Jarny, of Bry-Sur-Marne, France. It covers a process of condensing phenol and formadehyde in the presence of a large amount of calcium chloride, and yields products that differ in their behavior from the orthodox phenol resins of the past.

Kneadable

As contrasted with the dry pulverulent molding powders such as the ordinary phenol resins, de Jarny produces cold-kneadable masses from phenol and formaldehyde, and treats this somewhat like rubber dough is used. These products, either with heat or by mere pressure, and are subsequently hardened by further heating.

According to some of the formulas given in the patent, a plastic and pliant mixture can be obtained from the following:

(1) Metaparacresol	1500 grams.
40% formaldehyde solution	1250 grams.
Dry calcium chloride	350 grams.
(2) Raw phenol	1500 grams.
40% formaldehyde solution	1000 grams.
Dry calcium chloride	250 grams.
(3) Metaparacresol	2500 grams.
Tricresol	750 grams.
40% formaldehyde solution	2400 grams.
Dry calcium chloride	560 grams.

Preferably the calcium chloride is dissolved in the formaldehyde solution and the phenol is then added, the mixture being boiled under a reflux condenser to effect the condensation. The water produced by the condensation readily separates from the resin, leaving it practically anhydrous, and this is stated to be a great advantage in the process.

The resin is then mixed with about 2/3 of its weight of wood flour or saw dust and other fillers and coloring matter and kneaded on malaxating rollers like rubber dough until uniform, the temperature being from 40 to 50°C.

Molding

The molding is carried out in metal, plaster of Paris or even wooden molds. The injecting process, so popular abroad, is preferred by the inventor. The molds, if made of metal, are then heated in a hydraulic press at from 120 to 180°C. and under a pressure of from 100 to 300 kilograms per square centimeter. 15 minutes is considered about the right time for a proper cure.

When cold molding is resorted to, the molded articles are afterwards hardened by gradually heating them to 40 to 50° C. and gradually increasing the heat to 120°C. The time required is about four times as long as that when the heating is done in a press. There is but one claim, and this concerns itself with the use of a catalyzing agent the amount of which exceeds 15% of the formaldehyde used.

Phenol-methylene Resins

The second patent under discussion is assigned to S. Karpen and Bros., of Chicago, Ill. by Carnie B. Carter, of Pittsburgh, Pa., U. S. P. 1,645,226; Oct. 11, 1927. It concerns the production of phenol-methylene resins, which are analogous to the regular phenol-formaldehyde resins, by condensing methylals with phenol in the presence of acid catalysts. When dimethyl methylal is used, this decomposes into nascent formaldehyde and methyl alcohol (methanol) and the formaldehyde hence is in a very reactive state and readily condenses with the phenol.

A formula given reads as follows:

Methylal	4.6 grams.
Phenol	8.5 grams.
Water	22.8 grams.
Sulfuric acid	9.1 grams.

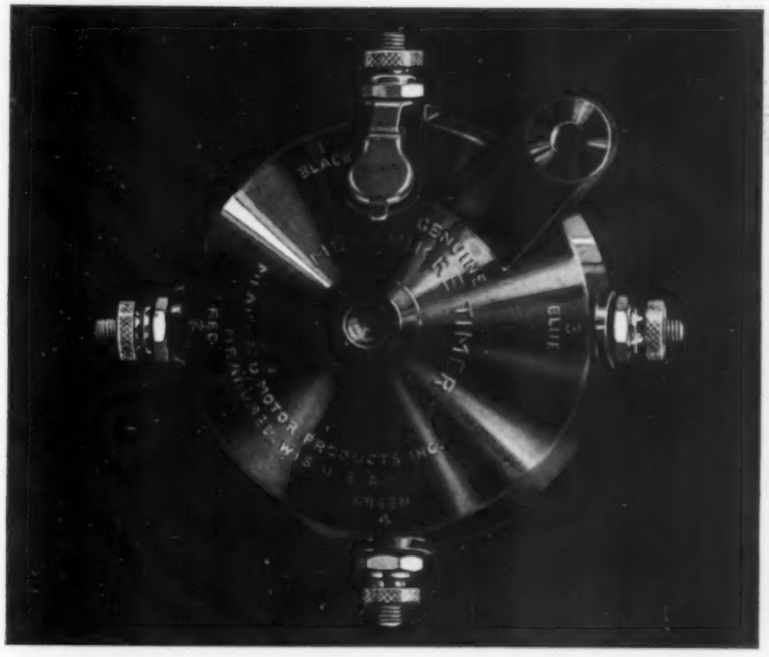
Such a solution contains 20% of acid, and the phenol and methylene groups are present in the proportion of nine phenolic groups to six methylene groups. By boiling this solution under a reflux condenser at atmospheric pressure, the reaction will be complete in a few minutes. The resin is worked up in the usual fashion. The alcohol necessarily produced in the reaction is recovered, one of the claims covering this feature.

Cold Molding

The third patent is the invention of Carleton Ellis, of Montclair, N. J., U. S. P. 1,645,693; Oct. 18, 1927, and relates to a phenolic resin composition especially adapted to cold molding operations.

The resin is produced by condensing a phenol and formaldehyde in the presence of sodium hydroxide. The resin is rendered adaptable for cold-molding by mixing it, or treating it, with a drying oil such as tung oil or China wood oil. The adherent film of tung oil is oxidized by heat so that the material, when mixed with asbestos and other filler will be sufficiently sticky

(*Continued on page 685*)



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EDITORIAL · IMPRESSIONS

Nineteen Hundred and Twenty Eight

THE year 1927 has been a particularly fortunate one for us, and the growth of PLASTICS during the past twelve months has been a great source of satisfaction. With the addition of the "Molded Products" section in May of this year, the size of the magazine nearly doubled, and in the final numbers of the year actually attained double the size of the numbers that we issued a year ago.

The continued growth in circulation, as well as advertising support leads us to believe that we are about to enter upon a still greater period of growth. Already recognized authorities even in Europe are using our pages as repositories of their original communications, and we sincerely trust that many of our American contemporary research workers in this field will follow suit.

PLASTICS was created primarily to serve everybody in the industry. An out and out chemical journal has entirely too broad a scope to treat plastic materials as they should be treated. The fact that our magazine so rapidly won its way into the hearts of its readers and secured the practical unanimous approval of all producers of material, machinery and fabricators, is a definite sign that it fills a niche long left vacant.

Better to serve the Plastics Industries is our aim for the coming year.

With this thought, we wish all of our friends a Very Merry Christmas and a Spendidly Happy and Successful New Year.

* * * * *

The N. E. M. A. and Standardization

THE inauguration by the National Electrical Manufacturers' Association (N. E. M. A.) of a special division to deal with molded products for use in their industries, constitutes an important step forward. Such a body should do much both to further the industries concerned and to safeguard the consumer.

Working hand in hand with the American Society for Testing Materials (A. S. M. T.), it might study the technical requirements of the thousand and one molded parts and devices of the electrical trades. Not only could this be done from the point of view of the properties of the finished parts, but also from the standpoint of the molding compounds. In regard to the latter, one of the functions of the committee would be to translate the compound behaving ideally during molding into the tests of the laboratory.

Such investigations would result in better molding technique. better products and all round simplification. Elimination of inferior products would follow the application of the specification provisions.

The drawing of a standard specification does not hinder progress. On the contrary, the intensive study of properties, requirements and tests necessitated by such investigations, frequently results in the revelation of new desiderata and widens the range of available materials. Such has been the experience of the British Engineering Standards Association, a body as representative as it is authoritative.

PLASTICS

The New Year should see this important work well advanced and its objects merit the close co-operation of all the interests involved.

The New Models

ONE of the great boons conferred on the public by the pyroxylin plastics industry is non-shatterable glass, a material consisting of two sheets of glass with a thin layer of transparent pyroxylin plastic interposed.

While its valuable possibilities were exploited during the Great War, it is as the peace-time automobile windscreen that it is rendering its greatest service. For we have it on reliable authority that fully seventy per cent of automobile hurts are due to flying glass.

The long awaited and widely heralded new Ford models are equipped with non-shatterable windscreens of a well-known make, with the result that there has been a phenomenal increase in this manufacturer's output. While this is of itself of great importance, it cannot be long before other makers of low and moderately-priced cars provide this standard equipment. All this means a wide and growing outlet for the pyroxylin manufacturers, a state of affairs very welcome to all concerned.

On another point, the new models are significant. We refer to the importance of color in everyday life. Time was when the Ford color range was black. Now, says the magnate of Highland Falls and River Rouge:

"The new Ford has exceptional beauty of line and color, because beauty of line and color has come to be considered, and I think rightly, a necessity in the motor car today."

Blood Plastics

LOW grade cheap buttons are made locally from a dried blood plastic compound, produced in two grades. The first grade called "Blutalbumin" comes in four shades, very bright, bright, brown, and black, and is imported from Germany and Austria where it is produced by several factories belonging to the Scheidermandel concern. This product is used chiefly for the dyeing of veneer and cardboard.

The second grade is used in the manufacture of low grade buttons by two factories, and is produced by one local firm also controlled by the Scheidermandel concern.

The plastic compound seldom comes on the local market since it is pressed into buttons in the same factories which produce it or is bought direct by these factories from foreign producers. In 1926, 126 metric tons valued at $1,365,000 crowns ($41,000 approximately) were imported chiefly from Holland, Switzerland, Austria and Germany. The foregoing information was communicated by E. Baldwin, U. S. Commercial Attaché at Prague.

CORRECTION

The very interesting articles on MOLDED ELECTRICAL INSULATION *that began in the June issue of* PLASTICS *and continued through July, thereafter being found in the* MOLDED PRODUCTS SECTION, *were the original work of* DR. ING. ARTHUR SOMMERFELD, *the Director of the large German plant of the Suddeutshe Isolatorenwerke, at Freiburg, i.Br., Germany.*

At the time these articles first appeared, we did not have the first name of this gentleman, and we therefore take this opportunity to make the present correction.

We have also been given to understand that Dr. Ing. Arthur Sommerfeld will contribute other original articles to our magazine, and we are pleased to number him among our European contributors.

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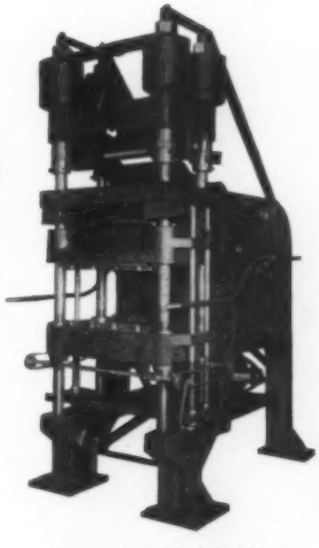

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TECHNICAL ABSTRACTS
AND PATENT REVIEW

Reducing viscosity of cellulose nitrate. Stanley De Vries Shipley; assignor to Atlas Powder Co., Wilmington, Del. U. S. P. 1,633,292; June 21, 1927.

Cellulose nitrate is heated in water. This brings about a partial decomposition, which is checked and accurately controlled by the addition to the water of salts that will act as "buffers" and control the hydrogen ion concentration of the water within a range of from pH 3 to pH 8.5. A mixture of **borax and acetic acid** is preferred.

Pyroxylin-Lacquer Composition. Bruce K. Brown and Charles Bogin; assignors to Commercial Solvents Corp. U. S. P. 1,641,529; Sept. 6, 1927.

To prevent blushing of pyroxylin lacquer films, a plasticizer, such as **butyl stearate** is employed. It is claimed that this is the best plasticizer thus far discovered, and will eliminate shrinking and cracking of the pyroxylin film composition. The **properties of the butyl stearate** are given as: (for the normal compound), water white liquid boiling at 220-225°C under 29 inches of vacuum. Solidifies with the formation of white crystals at about 22°C under normal atmospheric pressure. At 25°C the specific gravity of the liquid is 0.855. Secondary and tertiary butyl stearates may be employed instead of the normal compound. A typical formulas is: 8 oz. pyroxylin, 4 oz. butyl stearate, 1 qt. butyl acetate, 1 qt. ethyl acetate, 2 qts. benzol.

Manufacture of Synthetic Camphor. Leon and Etienne Darrasse, and Lucien Dupont; Vincennes, France. U. S. P. 1,641,579; Sept. 6, 1927.

In the process of making camphor from turpentine by converting the pinene into bornyl ester, saponifying the ester to produce borneol and oxidizing the borneol to camphor; the improvement which comprises acting on turpentine with oxalic acid and a liquid catalyst consisting solely of a halogenated open chain hydrocarbon at a temperature that is substantially the boiling point of the mixture.

Pyroxylin Plastics as a Covering Material and as Imitations. Production of Brushes. A. Bahls, Kunststoffe, 1927, **17**, 199.

An interesting account of the time-honored methods for making pyroxylin plastics mirrors, hand-mirrors, brushes and other toilet articles. Illustrated with objects and machinery employed for this purpose in Germany.

Hair-waving Comb. Sydney M. Wright, London, England. U. S. P. 1,642,636; Sept. 13, 1927.

This invention relates to combs for waving the hair.

Fig.1.

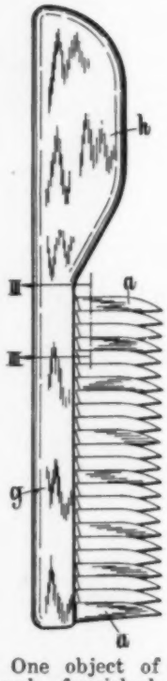

Fig.2.

Fig.3.

Fig.4.

One object of the invention is a comb furnished with teeth whose cross-section at right angles to their length is such as to leave spaces between the teeth which are tortuous or curved in a lateral direction so as to bend the hair and to impart a wave to the same when the comb is drawn through the hair. A further object is a comb in which the teeth have a concavo-convex formation in cross-section, the concave surfaces of the teeth facing the convex surfaces of adjacent teeth and so forth. Yet a further object of the invention is a comb in which the teeth are angular in cross-section taken at right angles to their length. According to one embodiment the apex of each angular tooth lies within the angle of the next tooth.

The invention also consists in a hair waving comb of moulded composition having teeth moulded with the back of the comb and of angular cross-section providing zig-zag gaps between consecutive teeth.

The invention further consists in the combinations of parts hereinafter set forth in the claims.

The invention is illustrated in the accompanying drawings, wherein

Figure 1 is a side view of a comb constructed according to the invention;

Figure 2 is an end view of the comb seen from the bottom of Figure 1;

Figure 3 is a cross-section of several teeth taken on the line III—III in Figure 1, and drawn to an enlarged scale; while

Figure 4 is a similar cross-section showing a modified form of tooth according to the invention.

Innovations in Manufacture of Casein Solids. E. Stich, Kunststoffe, 1927, **17**, 204.

Cut plates of casein solids were offered to the trade as early as 1914 by the Swedish **Syrolit Co.** These were well received by the piano-key industry, and were made from freshly precipitated casein. The German **Lupinite Co.** in 1920 first succeeded in producing pressed blocks from dry casein, and to cut these into sheets. This concern also worked up a mixture of casein and vegetable albumen; as well as mixtures of casein and pyroxylin. Further articles, giving details, are promised.

Recent Austrian and Swiss Patents on Phenol Condensation Products. Dr. Aladin, Kunststoffe, 1927, **17**, 208.

A further continuation of the abstracts of recent patents in the field of synthetic resins; covering both methods of preparation and of utilization.

Cellulose Ester Solutions. Joseph G. Davidson, Yonkers, N. Y. U. S. P. 1,644,417; 1,644,418; 1,466,419; 1,466,420; Oct. 4, 1927; assigned to Carbide and Carbon Chemicals Corp.

The inventions concern themselves primarily with solvents for the cellulose esters, such as cellulose acetate and cellulose nitrate. In the order named, the patents claim:

A composition of matter comprising a solution of cellulose acetate containing ethylene dichloride, ethylene glycol monoethyl ether, and a solvent for cellulose acetate having a higher boiling point than said ether.

A composition of matter comprising a solution of cellulose ester containing a substantial proportion of a monoethyl ether of a propylene glycol.

A composition of matter comprising cellulose acetate, monomethyl ether of ethylene glycol, and toluene.

A composition comprising nitrocellulose and ethyl glycol.

Casein as a Binder for Pigments. E. O. Rasser(Kunststoffe, 1927, **17**, 197.

The advantages of casein solutions for the making of paints is described; especial attention being given to a

German proprietary article. Linseed oil varnish is emulsified with the casein solution, to assist in rendering the painted surfaces waterproof.

Manufacture of Pyroxylin Plastic Brushes. A. Jaeckel, Die Celluloid Industrie (Gummi-Zeitung), 1927, 41, 2341, and 2453.

The commercial production of pyroxylin-plastic backed brushes, other than tooth brushes, is described and illustrated. The process consists essentially in drilling holes in suitably shaped pyroxylin plastic sheets, insertion of bristles, fastening of the same; backing and polishing. Machinery is also illustrated. As there are no molding operations, except when thin sheets of material are used over wooden forms, the process closely follows that already described in PLASTICS in connection with tooth brushes.

Plastic Compositions Comprising Pitch made from Oil Shale. Charles S. Reeve, assignor to the Barrett Co., New Jersey. U. S. P. 1,643,520; 1,643,521.

(1) The process of making bituminous products which comprises heating a mixture of two parts coal tar pitch and one part oil shale at a temperature which is above that required to decompose the kerogen in said shale and below that at which an appreciable amount of distillation will take place.

(2) The process of manufacture of a product containing bituminous matter, which comprises heating oil shale in the presence of coal tar oil at a temperature at which the kerogen of the oil shale is decomposed without permitting substantial distillation of the mixture, said coal tar oil having a boiling point above the boiling point of anthracene.

Production of Casein and Casein Adhesives. Antonin Rolet, in Le Caoutchouc et La Gutta-Percha, 1927, 24, pp. 13743 to 13745.

Describes the known methods for recovery of casein from curds, butter-milk, skimmed milk etc. Then takes up the preparation of various adhesives from the casein, giving a large number of working formulas.

Chemistry of Mixed Cellulose Esters. H. Gault and P. Ehrmann. Caoutchouc et Gutta-percha, 1927, 24, p. 13,748.

The preparation and properties of the following compounds of cellulose are described:

Cellulose acetonitrate and nitroacetate; cellulose acetobutyrates and cellulose acetopalmitates.

The first mentioned products may be obtained by (1) acetylating cellulose nitrate; by nitrating cellulose acetate, or by the action of a mixed nitrating and acetating bath on cellulose already slightly nitrated or acetylated. The acetobutyrates were described in German Patent 105947 of 1898 and prepared by the action of 198 parts of magnesium butyrate, 147 parts of acetyl chloride and 25 parts butyric anhydride on 162 parts of cellulose at 70°C.

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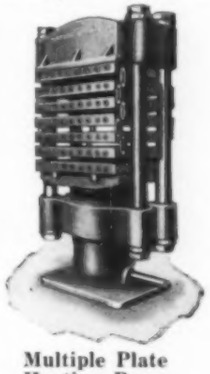

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Here is a new press for molding Bakelite, Redmanol, Condensite, Celluloid, etc., in which are incorporated certain features that increase production and decrease mold costs.

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3. The ejection stroke of the bottom dies is equal to the stroke of the main ram. This long stroke makes it possible to mold deep pieces and eject them without sacrificing any of the press opening.

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Improving Aldehyde Resins

German inventors are protecting their ideas on non-phenolic resins in America

THE Consortium für Elektrochemische Industrie, of Munich, Germany, has obtained patent protection (U. S. P. 1,643,496; Sept. 27, 1927) on a method of materially improving non-phenolic aldehyde resins. The inventors are Willy O. Harrmann, Hans Deutsch and Wolfram Haehnel.

The invention relates to a process for the improvement of aldehyde resins and is characterized by adding to non-phenolic aldehyde resins organic hydroxy-acids such as dihydroxystearic acid, ricinoleic acid, dihydroxyabietic acid, salicylic acid and the like. Instead of the hydroxy-acids themselves their derivatives or mixtures with other compounds may be used for example castor oil. By the addition of an organic hydroxy-acid compound the resins get a better elasticity, solubility and fusibility and sometimes a lighter colour.

Refining

It is known that in the manufacture of artificial resins by condensing formaldehyde with phenolic compounds the reaction is sometimes carried out in the presence of organic hydroxy-acid compounds but the process according to our invention does not relate to phenolic resins at all.

In carrying out the invention the resins are melted and the organic hydroxy-acid compound is added to the melted resin. The resins before being melted may be subjected to a refining process or an oxidizing treatment. The organic hydroxy-acid compound may also be added in any stage of the process of production of the resins e. g. in the beginning of the reaction or during the reaction.

Sometimes it is advantageous to carry out the invention under a pressure higher than the atmospheric one or in the presence of an organic solvent for the reaction-products, that is the organic hydroxy acid is added to the solution of the aldehyde resin and the solvent evaporated off.

The products obtained according to the invention may be subjected to the purification process e. g. by treating them with water or an aqueous acid solution in a ball mill or by dissolving them in an organic solvent and precipitating them from the solution by adding water. They may also be heated in the molten state for a longer time in order to improve their hardness, or they may be esterified since they contain hydroxyl and carboxyl groups. Finally they may be hardened by melting them with oxides of metals or their salts with weak acids to form resinates.

The products obtained according to this invention are used for the manufacture of lacquers, varnishes, polishing and insulating means and the like.

Example 1.

The resinous product obtained by condensing 500 parts of acetaldehyde with 300 parts of a 20 per cent caustic soda solution is melted with 30 per cent of its weight of recinoleic acid and kept in the molten state at 150° C. for a short time. Then it is rolled out in a rolling apparatus to shellac-like sheets. The product obtained shows a greater elasticity and a lighter colour than the resin started from and is very useful instead of shellac for the manufacture of varnishes and polishes and the like.

Example 2.

A resin, obtained by the condensation and polymerization of 100 parts of acetaldehyde with 550 parts of normal caustic soda solution at a temperature of 70° C. and after being heated at 120° C. for some hours is ground for two hours in a porcelain ball mill with an aqueous solution of acetic acid of 3 per cent strength. A fine suspension of the swelled resin particles is obtained. The resin is separated by filtering and melted at about 200°. To 100 parts of the molten product 30 parts of castor oil and two parts of aluminum oxide are added. The product thus obtained is more elastic, harder and lighter than a resin produced in the same manner but without addition of castor oil.

Example 3.

100 parts of a resin, produced by heating crotonic aldehyde in an autoclave for a long time, are melted with 75 parts of castor oil. A product with a melting point of about 60° C. is obtained. When slightly warmed, it is very ductile and may be used instead of wax.

Example 4.

1000 parts of acetaldehyde are condensed with 550 parts of a normal caustic soda solution at a temperature of 70° C. to 120° C. The resin resulting is dissolved in glacial acetic acid and this solution is subjected to an oxidizing process. The resin thereafter precipitated from this solution is not sufficiently fusible. By incorporating 50 parts of castor oil with 100 parts of this resin by melting the fusibility of the resin is increased.

Example 5.

100 parts of acetaldehyde are allowed to flow into 100 parts of a normal caustic soda solution, while stirring and cooling. After having added the acetaldehyde the reaction vessel is heated until a tough resin is formed, and salicylic acid is mixed to the reaction product in the proportion of 25 parts of salicylic acid to 100 parts of resin. The reaction product is heated for some time, then the volatile compounds are distilled off and the resin, remaining in the vessel, is heated up to 150° C. The resin obtained after cooling is ground in a porcelain ball mill for two hours with an acetic acid of three per cent strength.

Hereafter the resin is separated from the liquid, washed and heated for some hours at about 25° and finally brought into the form of shellac-like sheets by rolling apparatus. The resin obtained is more elastic, better soluble in alcohol and of a lighter colour than a product produced in the same manner but without addition of salicylic acid.

Example 6.

30 parts of castor oil are saponified with 75 parts of a double normal caustic soda solution and 100 parts of acetaldehyde are allowed to flow in while well stiring and cooling. The reaction product is heated for five hours on the reflux condenser. After distilling off the volatile products the resin remaining in the vessel is heated at 150° C. The product is isolated as described in Example 5. The resin obtained is more elastic, better fusible, better soluble in alcohol and of a lighter colour than a product produced under the same conditions but without addition of castor oil.

Example 7.

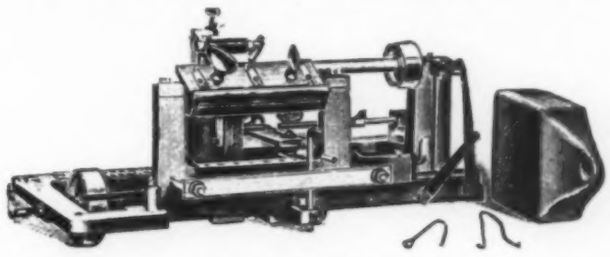
To solution of 30 parts of dihydroxystearic acid and 80 parts of a double normal caustic soda solution, 100 parts of crotonaldehyde are added. The reaction is carried out as described in Example 5 and a product is obtained with the qualities of the product there described.

Example 8.

100 parts of butyric aldehyde are allowed to flow into an autoclave which contains a mixture of 15 parts of a ten normal caustic soda solution, 300 parts of alcohol and 30 parts of castor oil, while well stirring. After heating for some hours at 180° C. the alcohol is distilled off and the resin remaining in the vessel is treated, as described in Example 5. By the addition of the hydroxy-acid the elasticity, solubility, fusibility and colour of the resin has been improved in a high degree.

Molded Products in Germany
See January

Comb Sawing Machines
FOR
Pocket, Fine and Dressing Combs



Comb Sawing Machine

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Wood Pulp Pyroxylin

(*Continued from page 660*)

Unlike the violent reactions occurring in nitration in drying machines, a considerable margin of time remains available which makes it possible to work steadily and to carry out, if necessary, in the course of working any test considered necessary. Such margin of time is greater, as the bath is colder. But it is advisable not to prolong the period of nitration unreasonably and to fix a maximum period of 24 hours, and for this purpose to maintain the requisite temperature of the refrigeration water.

The use of acid mixtures of suitable composition makes it possible to obtain from the wood pulp other varieties of nitrocellulose with the same facility as the "collodion quality," including explosives containing 13% of nitrogen. The quantities yielded do not appreciably differ from those obtained with cotton cellulose.

Washing

After the nitration and without removing the cover, the bath, after use, is evacuated by opening the outlet valve L. The acid mixture passes through the pipe M into the tank N provided underneath. Said bath is afterwards analyzed, recharged with fresh acids and conveyed by means of an elevator to the initial tank F to serve for a further operation.

When the vat is empty, about half an hour is allowed to elapse to permit the sheets of nitrated pulp to completely drain off, valve L is then closed and the washing is started. The washing water is supplied through the pipe O controlled by the valve P, fills up the tank, meets the overflow R and runs over into the drain pipe. This lixivation is carried on until the evacuated water shows no appreciable acidity. The washing is stopped by closing the valve P and the vat is emptied by opening the valve S.

The nitration operation is then completed. The cover C is removed and the parcels of sheets are withdrawn either with their grooved supports or with the aid of the glass rods upon which said sheets are suspended. The vat thus emptied may at once be used again for a fresh operation.

The nitrated sheets are then transported to the finishing workshop and placed, assembled together as they are, in wooden tanks or vats of a large size for the purpose of being therein stabilized, modified (as regards the viscosity of the solutions they are to supply afterwards), bleached and thoroughly rewashed, being immersed vertically in the various baths in the same way as during nitration.

Easily Handled

The wonderful consistency of the sheets of nitrated woodpulp enables them to stand a very long contact even with boiling baths. They are very easily manipulated with their supports up to the final drying which is effected either in a stove in vacuo or in any suitable dryer. After drying, the sheets are finally removed from their supports, cut and packed in any dimensions as in the case of ordinary cardboard.

If it is desired to keep the sheets in a moist condition, they are arranged in regular piles which are subjected to the action of a press for the purpose of squeezing out of them the water in excess before packing them. The moist sheets may also be reduced to small fragments by subjecting them to the rapid action of known rotary crushers, which at once transform them into a light pulp.

Advantages

As has already been stated, the process above described consists of operations entirely different from those which are generally followed in the case of cotton, lint, spinning noils, thin paper, etc., now used for the industrial manufacture of nitrocelluloses. It does away with the very dangerous and unhealthy use of nitration drying machines and requires neither heaters with acids, circulation piles nor dehydration turbines.

The sheets of wood pulp immersed in any liquid retain after draining very little of this liquid as compared with the quantities absorbed by cotton under the same circumstances.

Rubber that Molds

(*Continued from page 662*)

ial has approximately the properties described in Example 3 above.

Although carbon tetrachloride has been indicated as a solvent for rubber, it will be understood that various other solvents may be used such as chloroform, benzol, solvent naphtha and similar materials.

Furthermore other aldehydes than formaldehydes, butyl aldehyde and furfural may be employed. Acetaldehyde, benzaldehyde and aldehyde ammonia have been employed with equally good results. Instead of phenol, cresol or a homologue may be employed or a mixture of phenol may be used if desired with a mixture of aldehyde or with a single aldehyde.

The materials produced in accordance with the above procedures find application for the production of battery jars, knife handles, pipe stems, electric insulation, and in general may be employed for similar purposes to those for which bakelite and hard rubber are used. The processes mentioned above are inexpensive, simple and employ inexpensive raw materials. As compared with bakelite the material is practically free

from the odor phenol. In the molding process in the case of bakelite it is necessary to heat to a relatively high temperature and then cool to a relatively low temperature before opening the mold in order to avoid "blowing". In the present invention it is possible to mold at a low temperature and relatively little care need be taken in molding before opening of the mold.

The foregoing description is taken from the first patent in question. That vulcanized rubber also is suitable for the production of the new type of molding powder is evidenced from the second patent which recites a process involving the use of previously vulcanized rubber. In this second patent the inventor states that:

Using Vulcanized Rubber

With the use of vulcanized rubber as a prefered raw material, the invention broadly stated comprises combining chlorine, a phenol, and an aldehyde with vulcanized rubber and separating from the reaction mixture a plastic which consists of a rubber combined with chlorine, a phenol and an aldehyde. More particularly the invention consists in chlorinating vulcanized rubber, and combining therewith a phenol and an aldehyde and separating the combination product. The invention also includes the formation of articles and objects from the combination product thus produced.

The following example is illustrative of the invention: 100 grams of ground scrap or vulcanized rubber containing 1 to 5% of combined sulphur are dispersed or swollen in a container with 1000 grams of benzol. After dispersion is effected, chlorine is then introduced into the dispersion at a rate of about 10ccs. per minute per gram of rubber and the introduction is continued until the rubber molecule contains approximately 56-58% of chlorine. To this is then added a mixture of 150 grams of phenol and 150 grams of 40% formaldehyde solution in

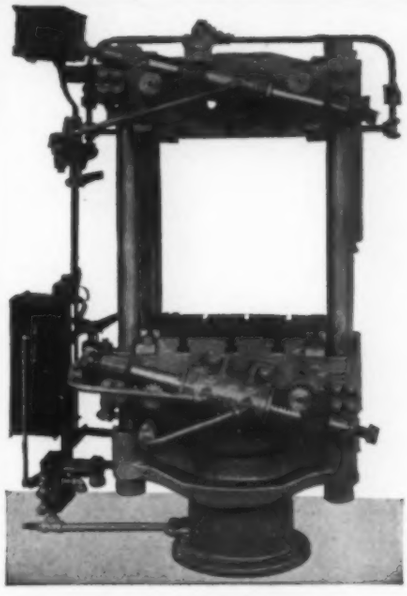

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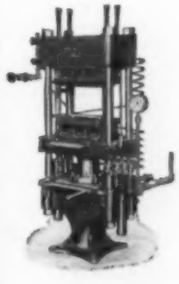
Fig. 1



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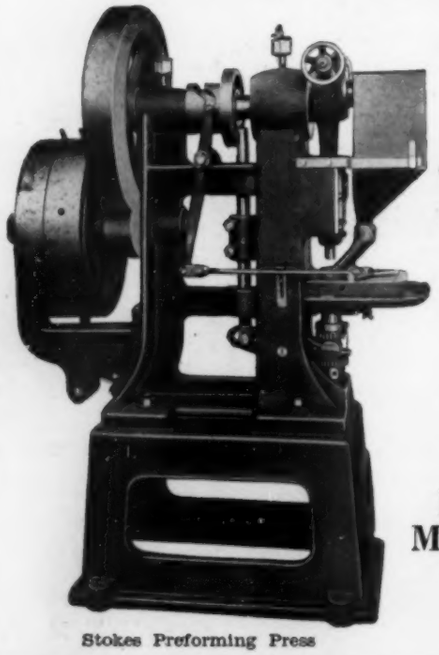

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water. The mixture is then heated under a reflux condenser at the boiling point of the solvent for 2-3 hrs. The product thus obtained is a thick brownish-white emulsion. The material may then be steam distilled or otherwise heated to remove the excess of chlorine and solvent, after which the product is washed and dried. The final product contains approximately 35% of chlorine and also contains, in combination with the rubber, both phenol and formaldehyde.

The above proportions are not absolute, but may be varied, depending on other conditions. Instead of benzol, other rubber solvents may be employed, such as carbon tetrachloride, solvent naphtha, chloroform, and others. It is known that these solvents do not dissolve vulcanized rubber, but merely cause the latter to swell. The amount of solvent in the above example is approximately 10 to 1 of rubber, but this amount will vary when other solvents are used. A suitable example of vulcanized rubber is that obtained from the scrap of inner tube manufacture, but obviously other sources of vulcanized rubber may be used.

With Reclaimed Rubber

If desired the vulcanized rubber may have been given a reclaiming treatment whereby the free sulphur and certain other ingredients are removed, but this is not necessary, as the chlorination treatment has the effect of removing substantially all of the sulphur as sulphur chloride, sulphur dioxide, hydrogen sulphide, or as free sulphur, and the removal includes practically all of the combined sulphur, thus leaving the rubber molecule containing practically nothing but chlorine.

Other phenols may be employed, such as cresol and higher homologues of phenol, and the higher aldehydes may be used such as acetaldehyde, etc. With certain types of vulcanized rubber, quantities of compounding ingredients are present. These may be allowed to remain in the vulcanized rubber, or they may

be partially removed prior to the treatment, but it will be found more economical to use what is known as a pure gum stock in those instances where the presence of compounding ingredients is not desired in the final product, or where certain specific ingredients are desired, such as wood flour, asbestos, zinc oxide or other of the compounding ingredients known to the rubber industry. These may be added at any stage of the process.

Strength of Product

The final product made according to the above example has a molding temperature of approximately 145°-150° C. and has a transverse tensile strength of approximately 7000-8000 lbs. per square inch. Assuming the dielectric constant of air as one, the product made according to the above example possesses a constant in the neighborhood of 2 to 3. The material may be employed in the manufacture of molded plastics, such as insulating materials, electrical instrument parts, and in other instances where hard rubber and "bakelite" are now employed.

Gelatin Glass

(*Continued from page 663*)

object can be easily removed from the mould.

It may some times happen that the article extends to a considerable depth over the mould and there may be difficulty in detaching it therefrom. In order to provide against this there may be a small hole formed to allow the air to penetrate between the article and the mould. This makes the removal of the article very easy. The small hole in the article is afterwards filled or plugged with a small quantity of the viscous material with the base of gelatine and zinc white.

The surface of the object after colouring is matt. To render it polished the article may be given the following supplementary treatment. It is replac-

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ed on the mould and is dipped briskly into the bath formed from 2% of collodion. On removal from this bath it is allowed to dry for a suitable time (about 2 hours) and the drying being complete, the article is dipped briskly into a starchy or amylaceous solution, and after being removed is allowed to drain and then dried for a day. After this, it is removed from the mould and is finished.

Tinting

The article obtained by following out the various operations just indicated has a brilliant surface and is coloured throughout its mass with veins.

If the article is to be given a uniform tint, the colouring, in place of being carried out in the manner above described is carried out in the following manner:—

The colouring material in place of being distributed in drops over the surface of the pure gelatine bath is utilized for colouring the bath completely, the colour being mixed therewith. The object is dipped into this coloured bath after the previous processes in the dry state.

If, in addition to the uniform colouring of the base it is desired to produce the effect of veins, the process just described is carried through in a first receptacle containing the bath of pure gelatine uniformly covered; and then after drying the vanes are produced by dipping the object into another bath of pure gelatine upon the surface of which drops of aniline colour of the desired shade have been distributed. The treatment with collodion and starch solution or amylaceous varnish is then carried through as previously indicated.

When the objects to be manufactured are not plain as is the case for instance with shades, globes or cups, it may be desirable to add resisting power in connection with the edges of the said articles, so as to avoid their deterioration.

With this object in view, the edge may be furnished after the article is manufactured, with a metallic ring clipped over it or

fixed in any suitable manner. The edge of the object may similarly in some cases be reinforced during manufacture by mean of a cotton ribbon.

The process is as follows:—

Immediately after having dipped the metallic mould into the solution of gelatine and zinc white a ribbon is attached round the bottom of the mould and the operation is then continued through the stages which have already been indicated. The dipping into the successive baths produces a contraction, and the ribbon is covered in and becomes incorporated in the article.

Hot Knives

(*Continued from page 665*)

irons are lowered with it, while providing the necessary resilience. For this purpose the heating irons 28, 29 shown as formed with studs or stems 33, the reduced upper ends of which project through holes in the side bearers 32 and are threaded to receive retaining nuts 34, the side bearers 32 passing through gaps 35 in the sides of the knife carriage 7, tension springs 36, 36 being fitted on the stems 33 between the heating irons 28, 29 and the side bearers 32, and supporting springs 37 being fitted in sockets 38, 38 to embrace the stems 33 below the heating irons while springs 39, 39 fitted in sockets 40 in the sides of the knife carriage 7 bear on the top of the side bearers 32. The arrangement of the heating irons is such that they can make light contact with the surface of the material to be cut. The tension springs 37 prevent the heating irons from fouling the surface of the material and spoiling its appearance, and the leading and following edges of the heating irons are shown as rounded with the same object. The supporting springs 37 and 39 serve to carry the bearers for the heating irons in a mean position suited to the height of the block to be cut and may also serve to take up inequalities in the heights of the heating irons pro-

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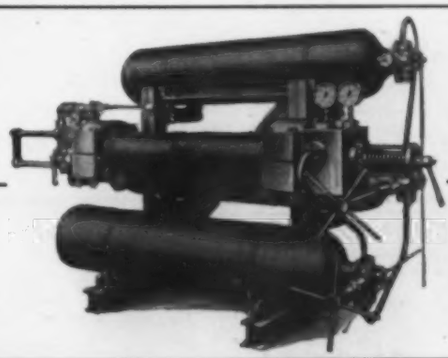

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duced by the operation of cutting.

The heating irons serve to heat the surface layers of the block or slab of material travelling beneath them to a suitable depth, say about equal to the depth of the desired cut.

In operation, the block of material keyed to the carrier plate referred to, is secured on the reciprocating bed 1 of the machine, and the knife and heating irons are lowered to the desired extent for the cut, the sheet being severed from the block or slab in the forward travel of the latter against the knife. The knife and heating irons can then be further lowered for the next cut and so on.

In order to secure heating throughout the necessary depth before removing a very thick sheet, the heating irons only may be lowered, the knife being removed, and the table be allowed to travel to and fro so that the block or slab is ironed by the heating irons, the knife being then replaced and lowered to effect the cut.

For Rods

The knife and heating irons might of course be reciprocated instead of the bed or table of the machine.

Instead of arranging the knife and heating irons to be lowered together, they may be arranged to be lowered independently of each other.

The process above described can be readily applied for the cutting of rods or like lengths of material of round, square or any other sectional shape out of blocks of materials of the character referred to, containing no volatile solvents or only very small amount thereof. For this purpose it is only necessary to employ heated knives or cutting tools of the required shapes according to the sectional shape of the lengths to be cut. In conjunction with the cutting tool an auxiliary device or devices for heating the surface layers of the block may be employed in a manner similar to what is above described. The tools for cutting the rods or other lengths of material may be of any known or suitable kind, such for example as the cold tools which are commonly employed for cutting such rods or lengths out of volatile solvent-containing blocks of celluloid, but provided with means for heating the knife or cutting tool, for example electric heating means similar to those above described for heating the sheet cutting knife. For cutting rods, for example, one or more tools comprising a circular cutting edge may be employed just like those usually employed for cutting rods from ordinary volatile-solvent containing celluloid blocks, but provided with electric or other heating means, and for clearing away the material or residue between the portions cut by the rod or like cutting tool, clearing tools like those usually employed for this purpose in cutting rods and the like from ordinary celluloid blocks may be used to clear away the residue between the cuts and straighten the top of the block, the clearing tool being also heated. The tools may be mounted in the known way in a frame or carrier adapted to be traversed across the block by a handle and screw, for cutting out the rods or like lengths consecutively across the block in the known way. In short the tools and cutting mechanism may be like those commonly employed for cutting rods or lengths out of ordinary celluloid blocks, but provided with heating means.

The traversing tool frame or carrier referred to may be mounted in place of the sheet cutting knife on the knife carrier block of a sheet cutting machine such as above described.

One or more heating blocks or plates for heating the surface layers of the block may be employed in conjunction with the cutting tools, and may be arranged to be raised and lowered together therewith or independently of same. For this purpose one or more heating plates or irons may be employed behind or before or both behind and before the cutting tool, similarly to what is above described, or one may employ the same heating plate or plates as those particularly above described for this purpose, simply substituting the cutting tool attachment in place of the sheet cutting knife.

Requires No Seasoning

Rods or other lengths obtained by cutting with hot tools as described present the advantage over those cut in the usual way with cold tools from ordinary volatile solvent containing material that they do not require to be seasoned at all or but very little and therefore do not undergo the distortion to which the latter are subject during the seasoning which they require.

For the purpose of the invention any other suitable machine or apparatus than that described may be employed, comprising a heated knife or tool, and any other suitable means may be employed for applying heat to the surface layers of the material to be cut into sheets or lengths.

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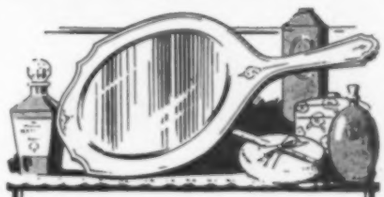

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Recent Resin Patents

(*Continued from page 670*)

to cause it to adhere when cold molded, and to retain its shape under the subsequent heat cure that the objects undergo.

One of the four claims reads as follows: "A molding composition comprising orthocresolformaldehyde resin, a drying oil and asbestos filler tempered to a state of coherency whereby the particles of the mixture can be welded together by applying heavy pressure in the cold; said composition being capable of becoming infusible on protracted heating."

An Aminoplastic

The fourth patent deals with the subject of ureaformaldehyde or "Pollopas" type of resins, and is assigned to the Societe Industrielle des Matieres Plastiques of Paris, by Henri Barthelemy.

Basing his work on proper hydrogen ion concentration control, this being practically automatic as the catalyst used is insoluble, and comprises calcium carbonate, Barthelemy proceeds as follows:

Mix one molecule of urea (corresponding to 60 parts by weight) with one or two molecules of formic aldehyde—used as a 30 percent solution, for instance (each molecule of formaldehyde solution corresponding to 100 parts by weight of 30% solution)—and add thereto 6 per cent of the total weight of freshly precipitated and washed calcium carbonate, preliminarily dried in vacuo at 150° F. The resulting reaction mixture is allowed to stand at 170° for 4 hours; it is then boiled for 4 hours.

Irreversible Colloid Formation

After filtering, one obtains a sirup which may be more or less concentrated in vacuo, and the result is either an amorphous dry extract which is hygroscopic and soluble in water, or a thick gum having the consistency of mucilage. The Ph of said gummy solution can be altered by the use of a well proportioned acid solution such as hydrochloric acid, or a known buffer solution having a determined Ph value, whereby the new colloid body will be spontaneously transformed into an irreversible colloid by heating to some 195° F.

For the production of the moulded and polished objects, the operation is performed by the use of molds of metal, glass or like rigid and non-porous material.

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Vol. 1 DECEMBER, 1927 No. 8

A Factor in Automobile Progress

A timely discussion of the function of molded phenol resinoid in aiding modern trends not only in the design and service requirements of the automobile but in the manufacturing methods of the nation's third ranking industry

By A. Moses

Culled from a recent article in Automotive Industries, "Production Progress—a glimpse into future possibilities", are the following significant statements—

"In 1925 the output per man in the automotive industries was three times what it was in 1914".

"The productive value of floor space is being studied".

"Limits of accuracy decreasing from one quarter thousandth to one tenth thousandth are increasingly evident".

Phenol resinoid products have taken an important part in these modern trends, a part, moreover, which bids fair to find its analogue in the development of the airplane.

* * *

ONE private car to every six persons . . . This tersely indicates the enormous market available for automobile components. Of the 22,000,000 motor vehicles in operation, at least 3,000,000 wear out every year, creating a replacement business amounting to close on 70 per cent of annual production at its peak. By the methods of the life insurance statistician, the average life of a car works out at 7.04 years. Further, with the rise to favor of the closed car, has come an increasing demand for accessories and replacement parts of fine finish and bright color.

One of Three Factors

As many as 200 phenol resinoid applications, both molded and laminated are known. Needless further to elaborate the close connection between the automobile industry and those engaged in the production and fabrication of phenol resinoid. In fact it has been stated that the latter is one of the three chief factors contributing to the success of the modern automobile, designed for quantity production and for operation with the minimum of trouble.

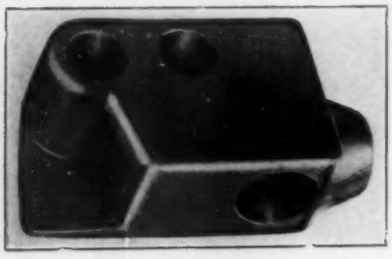
Molding is essentially a quantity production process. Applied to phenol resinoid it becomes a precision process, capable of effecting extensive economies. Numerous machine shop operations can be avoided. Machinery expensive to instal and costly to operate can be dispensed with, bringing a saving in valuable floor space. These economies result from the following inherent features of the molding process—the polish incidental to the molding process, the accuracy with which the details of the mold are reproduced in the finished piece and the facility with which metal inserts may be securely embedded.

Interchangeability

So that while meeting that most essential requirement of the replacement part — interchangeability, the phenol resinoid component contrives to fall in with those important though opposing tendencies — greater accuracy and higher production schedules.

So much for the mass production possibilities of the molding process. How about the properties of the finished parts? Mechanically, electrically and chemically they can fill the mani-

fold requirements of the modern automobile. Further, the modern passenger car is no fair weather proposition. Its components must stand up under the gruelling conditions of all-weather service.



Ground spring bushing in the fuelizer spark plug of the Packard "Straight Eight." Molded of Bakelite it is proof against short circuiting under difficult service conditions.

Properly molded, phenol resinoid is strong, has high insulation value both for heat and electricity, and is oil and water proof. While wood flour is the usual filler-reinforcement, by using graphite, asbestos or mica, it is feasible to meet special requirements. Besides, the molded resinoid can be obtained in a variety of colors and effects to harmonize with the usual automobile colors, and to fall in with the more decorative equipment necessitated by the vogue of the closed car.

Vogue of Vivid Color

The all-pervading vogue for vivid colors was never so evident as at the Automobile Salon initiated November 28th at the Hotel Commodore, New York City. Even the most conservative of manufacturers were in step with the march of color, Rolls Royce and Cunningham, for instance, featuring contrasting purples and brilliant orange combinations. No need to elaborate again the significance of plastic materials in these colorful trends. for the subject has already been dealt with at length in these columns.

Coming to the actual applications of the phenol resinoids, it seems logical first to consider the chassis. Due to the high stresses encountered in service, the laminated materials are particularly useful. They are strong, resistant to wear, weather, oil and abrasive dust and retain their insulation value under the strain of hard service.

In the spring system, they may form the spring pads; on the rear axle, particularly of trucks, the thrust washers, while by the use of laminated Bakelite insulation, it is possible to utilize the front bumper as an aerial for a built-in radio set (see MOLDED PRODUCTS 1927 page 365). A popular improvement is the fuel heating element in the intake manifold. Many of these are encased in laminated resinoid.

For the carburetor float, the molded resinoid can gainfully replace spun brass. For not only is the molded float gasoline proof, but it will not corrode.

Mechanism and Gears

Other molded equipment on the chassis mechanism comprises caps for radiator and fuel tank, fuelizer, spark plug, (Packard), washers and bushings on the latter and electrical gasoline gauge.

Gears cut from blanks molded of the laminated phenol resinoid are now standard equipment in the automobile timing mechanism. Silent in operation, resistant to heat , to moisture and to oil, they often outwear the metal gears against which they work. They are found not only on the timing gear but also on the crank gear, and front end drive. On the speedometer mechanism too, they perform an important if less arduous service.

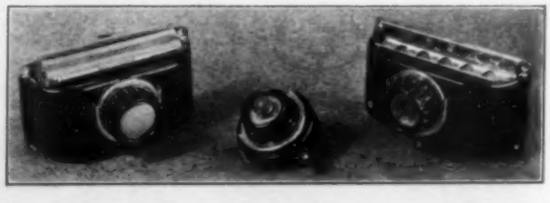
By reason of its high dielectric strength, a property maintained in face of oil, gasoline fumes and moisture, phenol resinoid contributes in many ways to the efficiency of the ignition system. Take the distributor unit for example. Apart from the universally used distributor heads, molded phenol resinoid may form such parts as the following:—high tension outlet cap, rotor, breaker arm, primary lead and bumper, as well as various insulating washers and bushings.

In this connection a new type of condenser instances very interestingly the value of the molded part for improving the whole product and for effecting economies both in manufacture and assembly. Formerly a fiber tube with metal caps, it has been supplanted by a metal tube with Bakelite end pieces, the contact strips in the latter being molded in. Molded grooves are provided to make a lock joint with the tube. Thus was appearance improved and several machine shop operations eliminated.

On the spark plug, a molded cover may guard the porcelain insulator from breakage (Franklin uses Bakelite) and on marine installations may prevent the formation of a conducting surface film of salt.

Coil Components

Coils afford plentiful opportunities for phenol resinoid products. They make the housings, caps, outlets and primary bushings. A striking example of the application of Bakelite parts to coils is the Pittsfield Master Coil, a product of the Pittsfield Mfg. Co. Displacing fiber for the housing, Bakelite laminated tubing is dimensionally more accurate. The molded cap with embedded metal insert facilitates refinement in design. The insulating cup for the secondary windings makes it unnecessary to seal these in asphalt. Inspection and repair are thereby facilitated.



Vanity, pipe lighter and smoker's set for British cars with Bakelite parts.

(*Continued on page 694*)

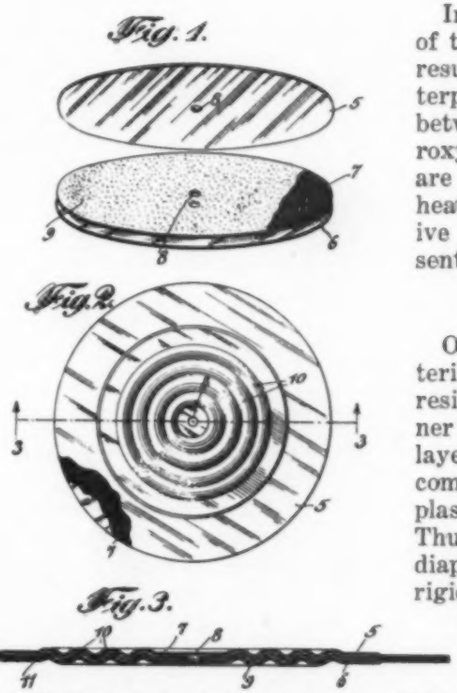
A Composite Telephone Diaphragm

Both pyroxylin plastic and shellac enter into the construction of this microphone diaphragm. The result is claimed to be a product with enhanced sensitivity, freedom from atmospheric influence and inexpensive production.

It has been stated that the telephone diaphragm, of soft iron or nickle-alloy alloy as ordinarily constructed, suffers from these drawbacks—low sensitivity due to its weight and liability to corrosion. To remedy these disadvantages, various methods have been proposed. For instance, the metal may be replaced by a plastic material, such as cellulose acetate or pyroxylin plastic. Again, a phenol resinoid diphragm with a very thin metal disc molded in may suffice. Here is described a third construction, in which enter both pyroxylin plastic and shellac.

* * *

PRIMARLY, the inventor aims to provide a diaphragm particularly intended for use in loud speakers, or as a sound producing element for the sensitive head phones of radio receiving apparatus. The diaphragm can also be used on phonographs and sound recording devices.



Telephone diaphragm consisting of two pyroxylin discs held together by Shellac-impregnated silk.

Past Efforts

In the past, numerous attempts have been made to produce a sounding diaphragm which would be of comparatively small area, and yet possess a good tone quality with the desired loudness or amplification. The general activity in radio has brought a renewal of such efforts and among other attempts to solve this problem, it has been suggested that the diaphragm be composed of a number of sheets or discs of fibrous material such as silk, cotton or paper, completely impregnated with and united by a phenolic condensation product.

In the manufacture of such diaphragms, it has often been found that the diaphragm when removed from the mold is distorted, and in some cases this distortion is of such degree as to make it unfit for use. Consequently, it is practically impossible to obtain uniform loudness and clearness of spoken words.

Advantages

The inventor proposes, therefore, to eliminate these deficiencies and to provide a sounding diaphragm which may be advantageously employed in connection with radio receiving or transmitting apparatus, may be very inexpensively produced, and which will possess superior tone quality and not be deleteriously affected by atmospheric conditions.

In one practical embodiment of the invention, these desirable results have been attained by interposing a single disc of silk between two thin discs of pyroxylin plastic. All three discs are permanently united under heat and pressure by an adhesive composition consisting essentially of shellac.

Chief Characteristics

One of the prominent characteristics of the new diaphragm resides in the fact that its inner area has a relatively thick layer of the interposed shellac composition and the pyroxylin plastic discs are corrugated. Thus the inner portion of the diaphragm will be relatively rigid. The diaphragm being centrally connected in the customary manner to the armature of the telephone magnet, it will be evident that the vibrations are uniformly distributed throughout the outer relatively then annular portion of the diaphragm. It has been found that owing to this equalized distribution of vibration, there is obtained a maximum loudness in tone together with a tone quality which is noticeably superior to that obtainable with other such devices.

The drawing illustrates one practical and satisfactory form of the invention, similar reference characters designating corresponding parts throughout.

Figure 1 is a perspective view showing the component parts of the diaphragm before assembling;

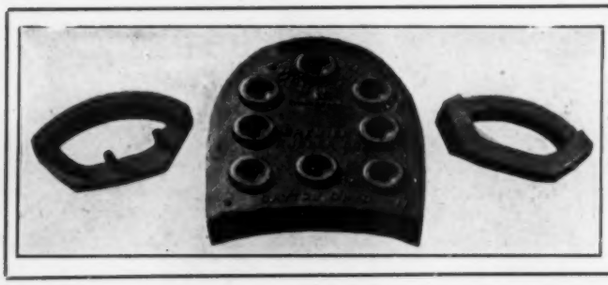
Figure 2 is a plan view of a diaphragm with a part broken

(*Continued on page 702*)

Successfully Resisting Wear and Tear

Two further cases of the successful replacement of metal by molded phenol resinoid calling for durability and durability plus good appearance respectively

THE writer once characterized our present epoch as "The Age of Molding" and in support of his theme, cited a number of examples of the successful replacement of metal, wood and other materials by molded products. Instances were given of the manifold advantages of the molding process—its economy from the view points of time, space and cost; its precision and uniformity for mass production processes. The whole gamut of products was drawn upon, ranging from switch plates to chair arms and from bearings to washing machine impellers.



Heel plates with locating pins molded in one operation. Durable, non-corrodible and good looking.

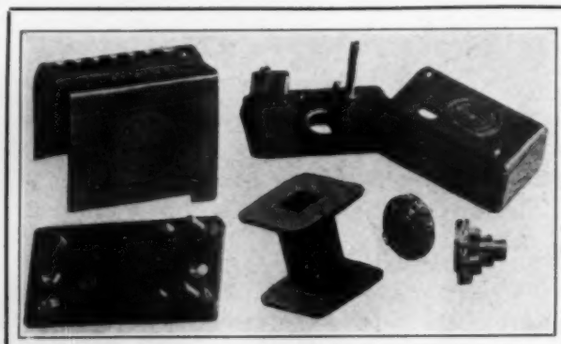
It would seem that mechanically, metals leave nothing to be desired. Yet one need only recall the phenol resinoid gear, and the Bakelite-Micarta airplane propeller to realize that even metals may have their shortcomings.

Metal Outworn

To bear the brunt of hard wear in service, the metal part is usually called upon. Instances occur however where the molded phenol resinoid part has outworn metal.

A case in point and a very striking one to boot, occurs in the magnetic counter made by the Production-Meter Service Corp. In this mechanism, are two ratchet wheels molded of the phenol resinoid Bakelite. After 30,000,000 continuous revolutions at the rate of nearly 17,000 per minute, these wheels had suffered no perceptible wear. Indeed, they stood up better under the gruelling than similar parts die-cast in brass.

This counter, moreover, supplies a highly interesting example of modern molding achievement. Thin walled molding, lettering in relief and particularly metal insert embedding are very well brought out.



The molded ratchet wheels (lower right) showed less wear than similar die-cast brass parts after 30,000,000 continuous revolutions at 17,000 per minute. The other components of the magnetic counter exemplify the highly developed state of the modern molder's art.

Courtesy Bakelite Corp.

In quite another department, one moreover which may have a personal import, the same tendency to effective metal replacement has appeared. Reference is made to the Bakelite molded heel plate used by the Johnson Rubber Heel Co. Thus does cast iron find itself at a premium for this hard wearing proposition.

Consider the requirements for an effective heelplate. Firstly it must be produced cheaply; this means mass production. The molding process produces the plate complete with its three positioning pins in one operation. What is more, by using a multiple cavity mold, the rate of production can be increased. In this connection it is appropriate to mention the collapsible tube top molded one hundred at a time.

Points of Superiority

Lightness in weight, non-corrodibility, absence of metallic clang are other points of superiority over metal. Then again by the use of suitably pigmented resinoid, correct matching of plate, heel and shoe becomes feasible, whether the latter be black, brown or tan. Thus whereas the iron plate may detract from the shoe's appearance, the Bakelite article may actually improve it.

It appears, therefore, that while equalling if not surpassing the hard wearing property of metals, molded phenol resinoid parts can frequently offer such other advantages as to make their use worthy of earnest consideration.

"The Age of Molding"

A new series of articles will begin in the January number.

The Story of the Silent Timing Gear*

The essential requirements for a successful timing gear and the points of superiority of laminated phenol resinoid materials for this purpose are interestingly explained.

By E. F. Behning

Formerly, Engineer, Gear Division, Diamond State Fibre Co.

According to the author, gear clatter and clash caused by metal-to-metal contact develops into an annoying whir or howl at high gear-speeds, and a material was sought that is flexible and resilient enough to absorb the vibrations or change their frequency to a pitch inaudible to the average human ear. Since vibrations in the crank, the cam and the generator shafts are transmitted to the timing gears which run at high speeds, a material was needed that would silence the consequent noise and provide a noiseless timing-gear train. A great variety of materials was investigated and the development of laminated phenolic condensation products resulted; these have proved mainly suitable for timing-gear-blank stock and stock for other gears such as those suitable for crankshafts and generator shafts. A further development was that of the flexible-web cam-gear made of the composition material.

The product described is made by bonding together in laminated form various bases such as paper, linen, canvas, or sheet asbestos, depending upon the grade that is to be produced, with a synthetic phenolic condensation resin. This resin can be hardened, made insoluble, infusible, and chemically inert to a high degree by the application of heat. Therefore, when once so hardened, it cannot afterward be softened or dissolved. Canvas-base material is the grade used in the manufacture of timing-gears and this article is confined to it. The other grades of the product are made in much the same manner except that other materials such as linen and paper are substituted for the canvas.

Gears made of the composition material, will, it is claimed, obviate unsatisfactory service and noise; they admit of quantity production, reduce expensive tear-downs on the production line to the minimum and assure silent, positive operation after a car is in service.

THE development of the so-called "silent gear" was brought about by the demands of engineers for the positive drive inherent in a gear installation without the clatter and clash due to metal-to-metal contact. A material was wanted that would, by its flexibility, absorb the vibrations or change the frequency to a pitch that would be inaudible to the average ear. In the automotive industry, the problem was to develop a silent timing-gear train.

With this end in view, experiments were conducted with a great variety of materials. For instance, in the early days, experimental gears were actually cut from wood. These gears operated quietly but did not wear long. It was thought that vulcanized fiber gears would solve the problem. This is a material made of chemically hardened cellulose. It is extremely tough and strong, is unaffected by oil, heat or cold, and can be machined readily. Furthermore, it had been used for years in the manufacture of gears and pinions for industrial applications. It possessed one property, however, which made it unsuitable for engine timing-gears;—its ability to absorb moisture. Vulcanized fiber gears performed satisfactorily until moisture collected in the crankcase due to condensation. This moisture penetrated the gear, making it soft and spongy, and the result was that it soon failed.

Rawhide and Cotton Gears

Gears made of rawhide held together with end-plates had long been used successfully in industrial applications, but they, too, were found to be unsatisfactory in engine timing-gear practice, because of the fact that rawhide deteriorates in hot oil. Experiments were next conducted with gears made by compressing cotton under high pressure and holding the mass under compression between end-plates by rivets. These gears had been successful in heavy-duty work in the industrial field. In timing-gear practice, however, they were found to be unsatisfactory. In some cases the rivets failed to hold and, in other cases, the helical teeth failed to stand the end-thrust and fractured. Furthermore, these gears were relatively heavy and developed a flywheel effect on the camshaft which, for some engine designs, was undesirable.

The solution of the problem was in sight with the development of the laminated phenolic condensation materials such as the product Celoron and other similar materials. These materials, made with a canvas base, possessed the properties necessary to function properly in a timing-gear train, these being:

*From Journal Society Automotive Engineers January 1927.

(2) Resiliency; that is, ability to absorb shocks and vibrations
(3) That it be unaffected by oil or moisture
(4) That self-supporting end-plates or shrouds are not required
(5) Light weight, about one-half the weight of aluminum
(6) Capability for being machined easily
(7) Silent operation

In the early days of the development of this material for timing-gear purposes, cam-gears were made by molding a thin rim of the composition material on to a large metal center or spider. This type of gear was fairly successful and was much superior to any of the other types mentioned. However, it was found that in some instances the rim loosened from the spider, probably due to the fact that the art of molding the blanks had not reached its present state of perfection. Furthermore, while this type of gear successfully broke up the metal-to-metal contact in the train and gave proper results on some types of engine, on other engines it was unsatisfactory due to the rigidity of the metal spider.

On Used Cars First

The next development was the use of crank and generator gears of the composition material, meshed with a metal cam-gear. This development was really brought about by the used-car trade. Certain dealers in used cars, in seeking a means of silencing the front ends of their engines to make them more saleable, obtained from indus-dustrial gear-cutters crank and generator gears made of laminated material. The results were so satisfactory that an enormous demand for this type of gear developed almost over night in the replacement trade. We believe it may be properly stated that this type of gear was the first successful non-metallic gear used in automobile timing-gear trains. As a result of its success in the replacement field, the attention of engine designers was directed to the further development of the non-metallic installation.

Standards of Silence

While the non-metallic crank and generator gears gave satisfactory results as compared with all-metal-gear practice, new standards of silence were set up and even better results were demanded by the engineers. This demand became insistent with the development of high-speed engines, and the consequent increase in the torsional vibration of the crankshafts. It was found in some installations that the mere breaking up of the metal-to-metal contact was not sufficient to give proper results, and that the small gears were not sufficiently resilient to absorb the vibrations set up at high engine-speeds. This was particularly noticeable in the generator gear which, due to its small size, failed to dampen the vibrations properly when running at a high peripheral-speed.

A phenol resinoid cam gear meshed with steel crank and generator gear.

As a consequence, in some types of engine, these gears did not give satisfactory results. Some of the gears actually broke in service, while others failed to silence the gear-train properly. Generally speaking, this type of installation was unsatisfactory when used in high-speed engines where the generator gear is actuated by the cam-gear and the generator runs faster than engine-speed. On two gear-trains, however, where the generator is driven by the fan belt, the installation have satisfactory results and is used today by a number of engine builders.

It was recognized that, to meet these conditions, some method of counteracting the vibrations other than through the resiliency of the teeth would have to be evolved. This led to the development of the flexible-web cam-gear now in general use.

This gear is made with an outer rim of composition material having the same thickness as that of the mating steel crank-gear and with a web of the same material approximately one-third the thickness of the rim.

Cushioning of Shocks

This web is capable of deflecting under shock and returning to its original shape as soon as the pressure is relieved. Shocks applied to the teeth are counteracted first by the cushioning of the teeth and, secondly, by the deflection of the web. On a test fixture in our laboratory, a load of 2000 lb. was applied directly to the hub of a gear-blank of this type at intervals of 3 seconds for 3 weeks. At each application of the load, the web deflected 1-8 in. At the end of the test, no evidence of fatigue or loss of elasticity was noticed. It is apparent that the ability of this gear to cushion or absorb the shocks and vibrations not only tends to eliminate the noise but also reduces the wear-and-tear on the surrounding parts.

Difficulties Overcome

While, for the reasons already mentioned, some difficulty was experienced on certain types of engine where the crank and the generator type of gear were used, we know of no case where the flexible-web cam-gear has failed to give satisfactory results. One important factor in this connection has been the progress made by automotive engineers in the last few years in improving the balance of the crankshafts and camshafts, and improved machining practices that result in holding center-distances within close limits. Today, with the improvements in design and in shop practice and

(*Continued on page 708*)

AN ANNOUNCEMENT!

OF IMPORTANCE TO EVERY BUYER of MOLDED PARTS

AN entirely new organization opens its doors in Meriden, Conn. New in name and equipment, new in ideas and methods though old in experience. The heads of this organization have had years of development work in the greatest advance in the history of the molding industry.

Cold molded products with all the advantages of this type of work may now be obtained under our exclusive process in a wealth of beautiful colors and mottled effects.

A huge completely equipped modern factory waits to serve you.

Investigate at once.

We will cheerfully furnish all information.

CONNECTICUT MOLDED PRODUCTS CO.

MERIDEN, CONNECTICUT

Formerly with the Connecticut Telephone and Electric Co.

Resinoid---Importance in Automobile Progress

(*Concluded from page 688*)

A graphite-resinoid composition is used for the molded brushes both on starting motor and generator. On the same gear, molded resinoid may form brush holders, terminal and junction blocks and nuts. Commutators may be assembled from laminated and metal pieces, or the whole may be molded. The cable conduit on the generator may also be a molded product.

Safe Switches

Switches too lend themselves well to the molder's art. The notably great resistance of resinoid material to high voltage electricity does not depreciate in use. For instance, base, drum, front and levers on the dash switch may all be molded of these products. On the lighting switch, the housings; on the floor starting switch, the top and post bushings; on the backing light and transmission switch, the insulations, have all been made of these materials. In use their original high polish and fine appearance do not deteriorate to shabbiness.

Durable Brake Linings

Clutch facings and brake linings of a resinoid-asbestos composition are being increasingly applied. In this connection, the Steeldraulic four-wheel brakes on the new Hupmobile "Six" come to mind. Not only are the molded linings on these appliances unaffected by oil, but their wearing properties are superior to the woven material. On the brakes referred to, adjustment is necessary only every 50,000 miles or so. (Bakelite Corporation's patent covering the production of these linings from resinoid, asbestos and cotton was described in PLASTICS, 1927,470).

The lighting system furnishes many examples of the application of molded resinoid parts. Three way plugs, connectors, bushings, dome light frame, insulation on cigar lighter, and spot light ball joint and handles are readily remembered. A recent instance, one that well exemplifies the possibilities of molded resinoid is the control knob on the Night Hawk Spotlight, a product of the Glassmobile Corporation, Detroit.

The laminated resinoid housing is dimensionally more accurate than fibre for this coil. The cap is also molded.
(Photo Courtesy Bakelite Corp.)

Two hemisperical Bakelite parts compose the knob, colored brown and black to indicate lateral and vertical movements respectively. Interchangeability and a uniformly snug fit are assured. A heavy bronze bushing is molded into each part without further operations. Use will not dim its high polish, an important consideration for a part subject to much handling.

Molded finger levers on the spark and throttle controls add to the attractiveness of the inside finish of the now so popular closed car.

Control Handles

Consider now the automobile body; first the control compartment. Constantly handled are the various control buttons and knobs on the brake handle, choke, ventilator and fuel pressure pump. Yet molded of phenol resinoid, this will not affect the beauty of their original polished appearance. A molded accelerator button too may insulate the foot from the engine heat.

Gear shift balls seem to have been a favorite subject for the fabricator of plastic materials. Pyroxylin plastics, casein solids and phenol resinoid materials have all been pressed into service. Carried out in effects varying from jewel-like onyx to colored pearl, they should harmonize well with the vivid color schemes so much in vogue.

In the Tonneau

Now the tonneau—To harmonize with the interior decoration scheme, laminated materials are available in a number of wood effects. Not only do these materials not dent in use, but they do not warp nor lose their initial high polish.

The telephone of course may be of molded resinoid, while the transparent resinoid material makes door pulls matching beautifully with the decorative scheme.

British cars are noted for the fine finish of their appointments. For their molded vanity case, smoker's set and pipe lighter, the London, (England) firm of S. Smith & Sons chose Bakelite, in colors in keeping with the upholstery and trimmings of the body. Their rich lustre endures.

Automobile and Airplane

Without any claim to completeness, enough has been said to demonstrate the importance of phenol resinoid materials in the development of the modern automobile. What of the airplane?

Says such an authority as William B. Mayo, a director of the Pratt & Whitney Aircraft Co. and Vice President of the Ford Motor Co.'s Airplane Division:

> "It has been stated occasionally that the only claim of kinship the automotive industry has with the airplane lay in the fact that both use internal combustion engines. The relationship is much closer than this".

And again:

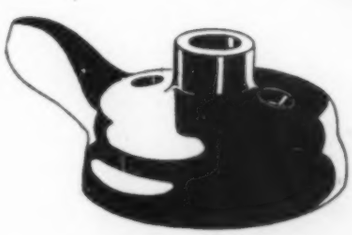
> "The airplane is nothing but an automotive vehicle of slightly different form—Even in the design of passenger accommodation, the trend is following that of the automobile".

Auburn

Automobile Parts

- Auburn Molded -

Painstaking selection of raw materials plus exacting workmanship produce parts that will function smoothly with everlasting endurance.



Auburn Button Works, Inc.

AUBURN, N. Y.

Plastics in Everyday Life

A human interlude on the theme of the various and intimate points of association of plastic materials with life, from cradle days, through youth to old age.

JUST think! Within a comparatively few years, pyroxylin plastics have fitted themselves into so many phases of the modern man's habits, that they have linked themselves inseparably with his existence, practically from the cradle to the grave.

What, for instance, is the first object an adoring mother puts into the infant's tiny fingers, as soon as its consciousness begins to delight in colorful articles? A blue or pink pyroxylin plastic rattle, of course! And soon, too, baby's teeth have their coming out party on a teething ring of similar material.

"Let's play house," gleefully cries the young miss of tender years, and she smartly arranges her pyroxylin children in obedient rows. "Aw, no", objects her scornful little brother, "Le's play sojers", and there he has a military arrangement of beautiful scarlet and gold pyroxylin soldiers.

School age brings with it an imposing array of composition products. Little ones are taught to use their tooth brushes—brushes with lovely ivory handles, colorful amber or green handles, but all cleverly molded from composition products. A composition comb tidies the youngster's hair, composition buttons line the back of the little girl's dress and the front of the little boy's jumper suit, composition fountain pens and pencils labor over the homework, and then, lessons done, playtime comes with its composition balls, bicycle pedals, proudly displayed knife handle and watch fobs.

The manifold points of contact of plastic materials with every-day life are well brought out by this collection of Erinoid articles exhibited at the recent Chemical Industries Exposition. It includes gear shift balls, cutlery, and manicure articles.

The young man of the house now reaches the trying age when girls loom importantly on his vision. The weekly shave is a ritual in which he wields a pyroxylin handled shaving brush, and having finished, tucks his safety razor into a pyroxylin case. Meanwhile the young lady who eagerly awaits his arrival, seats herself before her dressing table, on which is arrayed her boy friend's Christmas gift, a toilet set, with powder box, hair pin container, mirror back, brush back, compact, lip stick holder and handles of numerous manicure utensils, beautifully turned out in amber, edged with mother of pearl, which in reality found their origin in pyroxylin plastics.

(Continued on page 706)

"If You Want a Thing Right and in a Hurry, Go to a Busy Man"

THAT old saying must have been said about the molding business. We're busy now, always are, but every day we're doing complicated jobs and rush jobs that customers say they've never been able to get elsewhere.

The reason is simple. Being busy, every job has a definite scheduled time. That time must be met, or our whole schedule would be shot. So it *is* met—and often bettered.

Same idea when your order includes the making of the molds and inserts. Unless the mold is exactly right, the finished molded pieces will not be right. Then our own inspectors would throw them out. So the molds *are* right, to your tolerances or better.

And inserts. Unless they're exactly up to specifications they won't fit the mold, and that would mean delay. So we see to it that they *are* exactly up to specifications, the very first time.

The whole thing is our worry, not yours. You need only specify what you want and when you want it, and for our own sake we've *got* to deliver. No sentiment about it—just plain business. But customers tell us it's the best help they've ever found for getting molded jobs the way they want them, and *on time*.

Step Out Ahead

More and more manufacturers are learning the hundred and one advantages molding can add to their products. Many products which a year ago seemed impossible to mold are now made no other way.

Before your competitor seizes upon molding to improve product and cost, let us discuss your product and the possibilities molding may offer it.

Cost? Most products can be molded complete, with metal inserts, in one operation. Costly machining, hand labor, assembling are done away with.

Salability? Products can be molded in black, attractive colors, or in unusual mottled effects, to improve appearance and add distinction. And the colors are permanent.

Durability? Properly molded, by responsible molders, a product is impervious to oil, water and solvents, and resists acids. Nickleplating solutions will not harm it. Wear, weather and exposure will not affect it. Heat up to 300° F. will not mar it.

These and many other advantages of molding can be added to your products. May we discuss possibilities with you?

PRECISION MOLDERS OF BAKELITE AND SHELLAC COMPOSITION

INTERNATIONAL INSULATING CORPORATION

ESTABLISHED 1875 ELYRIA, OHIO

Steering wheel headlight control and horn button frames. Both complicated in design but finished complete in one molding operation.

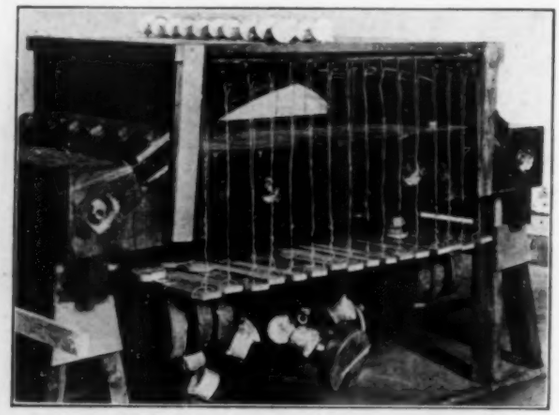
Molded base for the Dulce-Tone radio-talking-machine-speaker, with six threaded brass inserts imbedded. Finished complete when taken from the mold.

Molded connection plugs for electrical appliances are much stronger and retain their attractive polish.

Pyroxylin Plastic Aids the Engineer

Using models of Celluloid, Prof. Beggs of Princeton's Engineering Faculty can accurately gauge factors of safety and effect economies in construction

WHILE the application of pyroxylin plastic materials to the solution of engineering problems is not new, recent developments have served to bring it into prominence again. We refer to the use of Celluloid models of bridge arches and dams in determining the behavior of the actual structures under working conditions. And this is not all. By indicating the factor of safety with certainty, it is possible to reduce the amount of concrete going into the structure.



Prof. Beggs' set-up for testing the Celluloid model of the arch of the Arlington Memorial Bridge.

Developed by Prof. George E. Beggs of the Department of Civil Engineering of Princeton University, the method was used last year in connection with the Arlington Memorial Bridge across the Potomac River, Washington, D. C. Recently the Stevenson Dam near Fresno, Cal., was the subject of a similar study.

Professor Beggs used a model of one of the arches of the proposed bridge, determining the deflections in the model under certain test loads hung on the sides, to represent the weight of the granite facing walls. The model of the arch, one-fiftieth full size, was made of Celluloid. For parts of the model Celluloid as thick as one and a half inches was used. Measurements of the deflections caused by the test loads were read at 154 points.

The Professor Explains

As a result of his work, Professor Beggs found that the cross walls of the proposed structure will distribute very satisfactorily the weight of the granite facing walls. In fact, the bridge will support facing walls five times as heavy as those planned without any alarming distortion.

In the words of the Professor:

"By taking into account the ratio between the elasticity of Celluloid and concrete, as determined by experiment, as well as the scale of the model and the ratio of the test load to the actual load, it has been possible to translate the deflections of the model into the actual deflections of the bridge."

"The average of the measured deflections, when translated, agrees with the computed deflections of the concrete structure within one hundredth of an inch."

Also, using his "Deformeter" method in connection with a flat Celluloid model, Professor Beggs found that the stresses in the proposed arch were greatly reduced by the action of the monolithic superstructure of the roadway floor and its supports to such an extent that it has been possible safely to reduce the dimensions of the arch rib at a saving of more than $24,000 in the cost of concrete.

In testing the concrete arch dam in Stevenson Creek Canyon, Celluloid was used instead of concrete, mercury instead of water. The reproduction involving measurements of a millionth of an inch was accomplished by Prof. Beggs.

The original is 60 feet high and 140 feet long. The dimensions of the model, which is 18 inches high, and a little more than half an inch thick, are one-fortieth of the dimensions of the original.

Model Construction

The gorge or canyon of the model is made of concrete, without, of course, the irregularities of the natural rock. By bending several sheets of Celluloid, cementing them together, and then carving the face, a model of exactly the same shape as the real dam was produced.

Since the pressure of a fluid against a dam varies with its depth and not at all with the distance it extends back of the dam, it was sufficient to make the reservoir for the Celluloid model only one-quarter of an inch long.

In other words, it was simply a space of this width formed by sealing into the concrete parts of the model a sheet of Celluloid

(*Continued on page 708*)

A Special Message from The Siemon Family

The Siemon Company
Bridgeport, Conn.

The Specialty Insulation Mfg. Co.
Hoosick Falls, N. Y.

Duranoid Manufacturing Co.
Hoosick Falls, N. Y.

The Watertown Manufacturing Co.
Watertown, Conn.

The Colasta Company
Hoosick Falls, N. Y.

The American Composition Co.
Watertown, Conn.

You, a present user of moulded parts, or a prospective user of these parts are not interested in illustrations of the thousands of parts that we make for hundreds of various uses. You are only interested in securing prices and service from a dependable source of supply.

Our organization, twenty-five years old, is complete in being able not only to supply the practical brains for solving your moulding problems but is also complete in being enabled to supply you with all of the moulding material, and also mechanical equipment required from our own plants and under our own supervision.

Expensive and extensive laboratories not backed by practical compounding and moulding experience mean nothing.

A manufacturer who must depend on outside sources for the supplying of his customers' needs for moulding material and mechanical equipment, you will admit, is certainly at a disadvantage insofar as being in a position to guarantee quality, price and service when compared with a competitor who has plants completely equipped to supply everything without outside help.

SUMMARY

WE HAVE THE PRACTICAL MOLDING BRAINS

WE ARE COMPLETELY EQUIPPED

OUR GUARANTEE IS YOUR INSURANCE FOR SERVICE, QUALITY AND PRICE

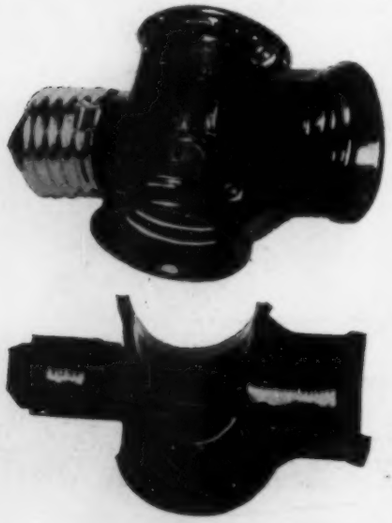
Two New Ideas in Sockets

Two new 3-way sockets are described embodying different methods of holding the metal contacting parts

For reasons recounted time and again, molded phenol resinoid is extensively used for wiring devices. Here are two very good examples of what molding can achieve with these materials, when applied to three-way sockets. One, already covered by U. S. Patent No. 1,644,593 issued to William Ile and assigned to the Reynolds Spring Co., well illustrates how molding can simplify construction. The other, on which patents are pending to the Beaver M. & T. Co., is an interesting two-piece molding proposition.

* * *

As depicted in the illustration, the Beaver socket consists of a body molded of Bakelite in two halves. These are held together by means of screws and bolts at two points and enclose the threaded metal linings designed to take lamps or other devices. Other exterior constructional details will be evident from the illustration. The whole is remarkable for its simplicity and its snugly fitting parts are a tribute to the precision in molding of the phenol resinoids.



Beaver M. & T. Co.'s two-piece 3-way Bakelite socket. Below is one half of the molded shell

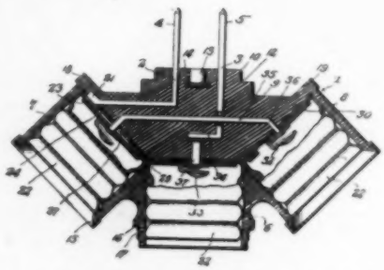
Embedding Conductor Bars

Mr. Ile's invention aims to provide a simple, practical and efficient three-way cluster lamp socket of strong, durable and comparatively inexpensive construction. It is designed either to receive lamps or for tapping a circuit or other purposes and is equipped with an insulating body molded of a single piece of phenol resinoid or other insulating material. Conductor bars are embedded in it and it is adapted to afford rigid connections which will not become loose when the lamp or other threaded element is screwed into or out of the socket. A further object it to provide a three-way socket equipped with spaced projecting contact fingers.

In the accompanying illustration, the three-way socket is equipped with an insulating body 1 consisting of a single piece of molded phenol resinoid having shell and center contact conductor bars 2 and 3 molded in and projecting from the top of the body to form a pair of spaced contact fingers 4 and 5.

The insulating body consists of a central socket 6 and side sockets 7 and 8. These are formed in one piece with an upper solid body portion 9 in which the conductor bars 4 and 5 are molded. The portion 9, above the central socket and between the side sockets, has flat side faces and tapers downwardly.

The enlarged circular upper portion 10 is adapted to receive a cap to equip the three way socket with a screw plug at the top. It is provided with a recess 12 to take a cap and is also equipped with a threaded bushing 13 embedded in the insulating body. A corrugated flange 14 is molded in for securely anchoring the bushing. The latter is adapted to receive a threaded bolt and the corrugated flange will prevent any rotary movement of the bushing when screwing the bolt in or out.



Vertical section through Mr. Ile's socket, showing the method of inserting the conductor bars.

The side sockets 7 and 8 are provided at their lower outer ends with exterior beads and are bevelled as shown at 15. The central socket is provided with an exterior bead 16 and has exterior threads 17 located below the bead. Exterior beads or ribs 18 and 19 provide a construction of increased strength and durability with a minimum amount of insulating material.

Electrical connection is established between the shell contacts by soldering the adjacent portions as indicated at 29, apertures being provided at the top of the center socket 6 at opposite sides. The shell contacts are perforated to permit effective soldering.

The shell contacts are retained firmly in the sockets by insulating disks 30 of grey fiber or other suitable material, fitted

Scranton Parts

Parts like the above insulator must be perfect to the hundredth part of an inch.

Here is the largest plant of its kind, Scranton turns out millions of such parts in Phenolic, Bakelite or Lacanite. Each piece must pass a test of exact thoroughness before it can leave Scranton's plant.

The Scranton Button Co.

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Who Are Responsible for reducing costs should make a study of your product with a view to the economy of using parts or whole articles molded of Kellite, the product of Kellogg's composition Molding Department

Remember, Too,

that your whole molding job can be done here, including the stamping or machining of any type of metal inserts, thus insuring well finished parts and the most exacting accuracy.

Send us your blue prints or drawings. Kellogg engineers will be glad to help you with your problems.

Kellogg Switchboard & Supply Company

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CHICAGO, ILL.

against the lower faces of the flanges 23 and provided with central openings through which passes the attachments for center contacts 32.

Composite Diaphragm

(*Continued from page 689*)

away; and

Figure 3 is a sectional view on an enlarged scale, taken on the diameter 3—3 of Figure 2.

Referring to Figure 1 the diaphragm is shown as composed of the two discs of pyroxylin plastic 5 and 6 and a disc of silk or other equivalent material 7, as light in weight as can be obtained, which is interposed between the two former discs.

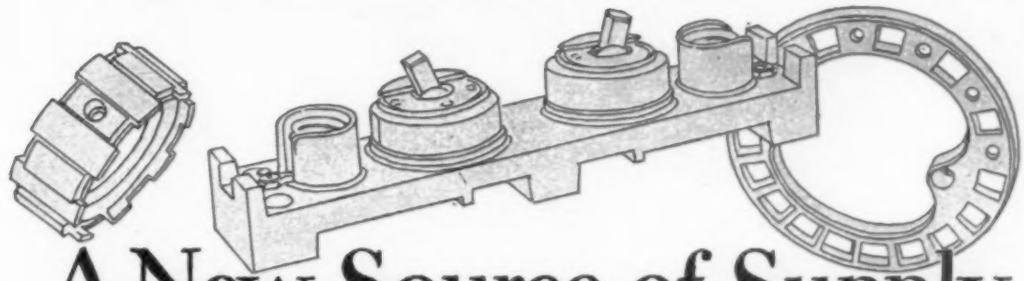
The several parts of the diaphragm are preferably of uniform diameter, each of the discs 5, 6, 7 being provided with a central aperture 8, to receive a centering pin on one section of a mold (not shown).

Method of Compositing

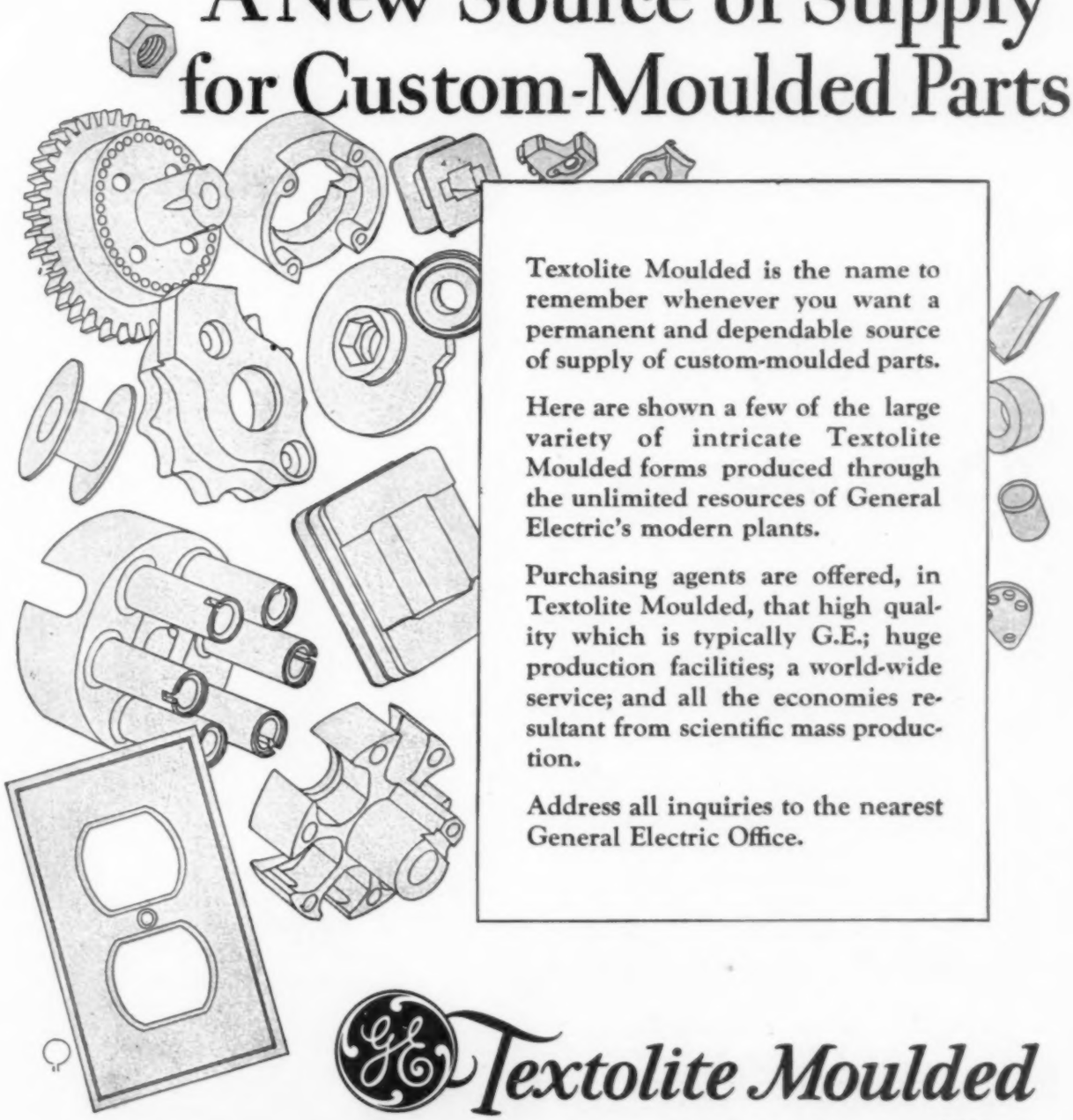
The disc 6 is first arranged upon the center pin of the mold followed by the silk disc 7. A mixture of two parts of powdered shellac and one part of powdered mica is then spread over the silk disc 7 in a layer of uniform thickness as indicated at 9. Very good results can be obtained with shellac alone. Finally the other pyroxylin plastic disc 5 is placed on top of the powdered material 9. The mold is then closed and heat and pressure applied.

Soon the powdered shellac will melt to produce a plastic mass which thoroughly permeates the silk disc 7 and unites the two discs 5 and 6. In practice very satisfactory results are obtained with pyroxylin plastic discs approximately .004" thick. As shown in figures 2 and 3, the opposing mold faces are so formed as to produce a series of annular reinforcing corrugations 10 in the inner area of the diaphragm. It will also be noted that the adhesive composition between the inner portions of the pyroxylin plastic discs is rela-

G-E TEXTOLITE MOULDED



A New Source of Supply for Custom-Moulded Parts



Textolite Moulded is the name to remember whenever you want a permanent and dependable source of supply of custom-moulded parts.

Here are shown a few of the large variety of intricate Textolite Moulded forms produced through the unlimited resources of General Electric's modern plants.

Purchasing agents are offered, in Textolite Moulded, that high quality which is typically G.E.; huge production facilities; a world-wide service; and all the economies resultant from scientific mass production.

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Textolite Moulded

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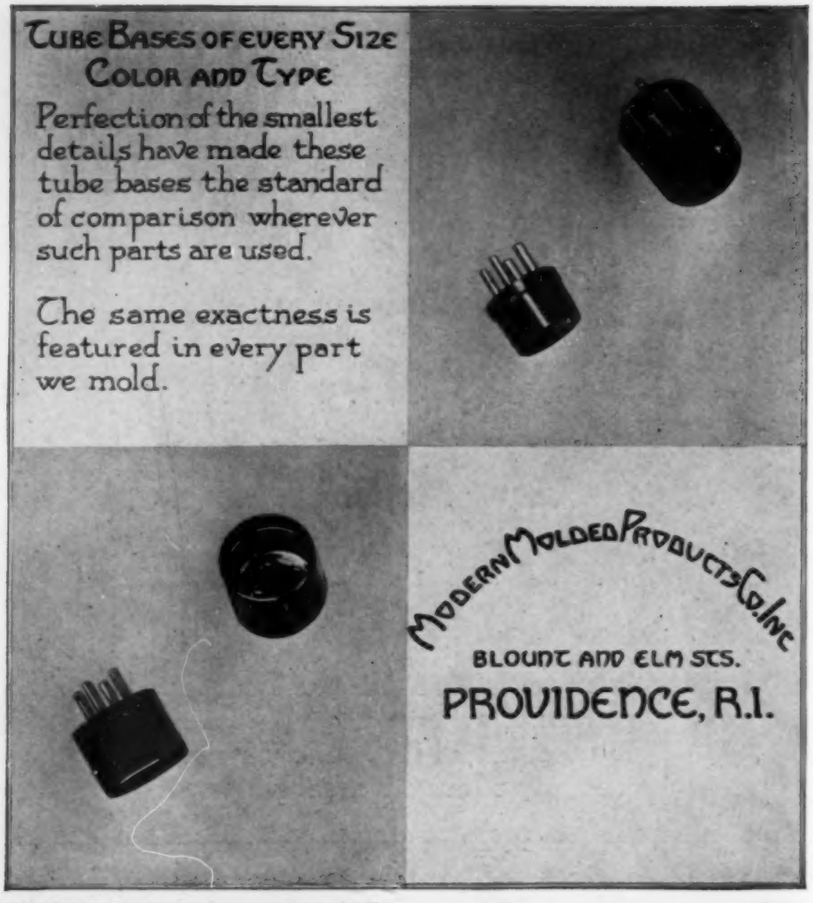
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tively thick as at 11 in Figure 3, while that portion between the outer sections, is relatively thin as at 12.

It will be understood that the pyroxylin discs retain their individual disc-form and are not amalgamated with each other or with the interposed layer of adhesive composition. The primary purpose of the silk disc is to provide a binder acting to prevent the possible breaking down of the layer of shellac composition.

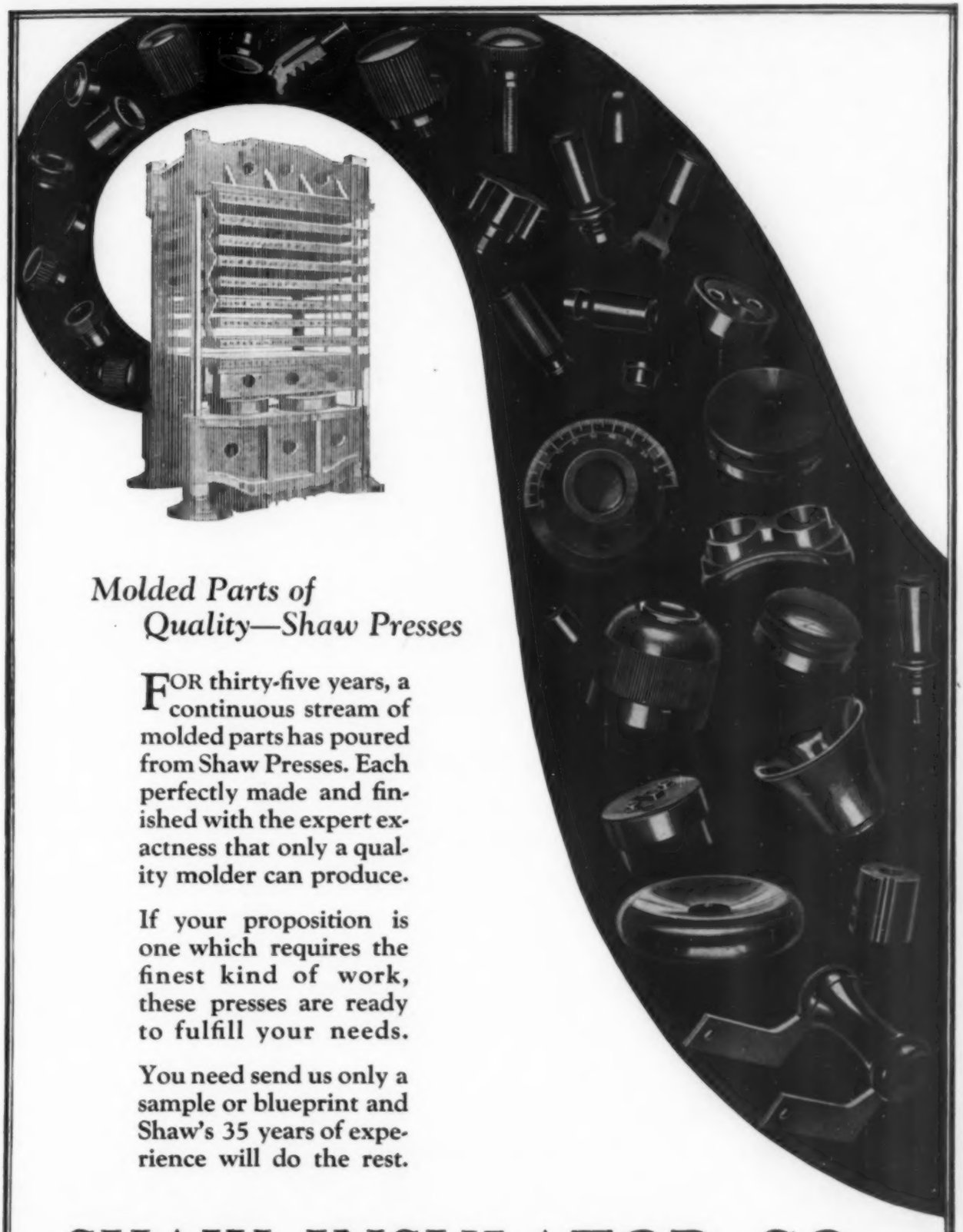
Advantages of Pyroxylin

In actual practice pyroxylin plastic is more uniformly responsive throughout the diaphragm area to vibratory influences than other materials previously used. However, the principal gain from the new construction is the practical elimination of the deleterious effects of variations in humidity and temperature upon the structure of the diaphragm, causing warping or distortion. This is due to the use of a minimum of moisture-absorbing material in the diaphragm structure.

Thus this outer annular section of the diaphragm will be comparatively flexible while the inner thickened portion is more rigid. Through the medium of the connecting rod between the armature of the telephone magnet and the center of the diaphragm, the inner portion of the diaphragm will move as a unit with the rod and the flexure of the diaphragm will take place between the outer edge of this thickened area and the extreme edge of the diaphragm clamped between the body and rim of the magnet.

Elastic Adhesive Material

The entire outer ring of the diaphragm will share in the vibration. The adhesive material, whether of shellac and mica, or of shellac only, is sufficiently elastic to permit of such vibration of the diaphragm without cracking the adhesive material. Such uniform distribution of the vibrations leads to a highly accurate translation of the voice currents into sound waves so that very clear, loud and distinct tones will result.



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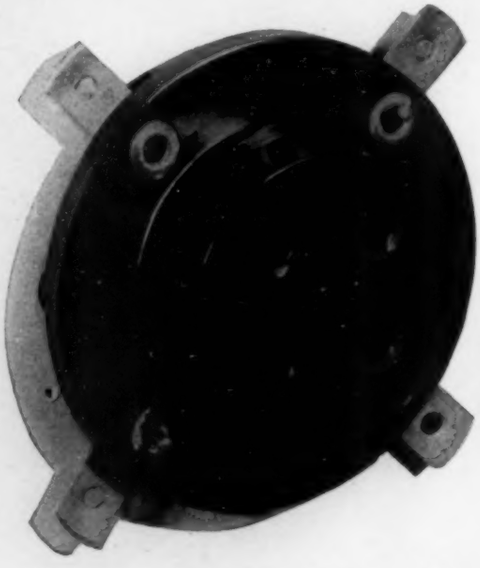

Radio Tube Socket

A remarkable example of Bakelite molding with metal inserts.

Molds made and production started at very short notice.

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23 W. Third St. Cincinnati, Ohio
Molders of Bakelite

Molded Products

This method of enhancing the sensitivity of the microphone diaphragm is covered by U. S. Patent 1,646,261 issued to Lambert Schmidt on Oct. 18, 1927 and assigned to the Radiotive Corporation, New York. The application was filed more than four years ago. References to other ways of attaining the same end will be found in PLASTICS *III, 299,494.*

* * *

In Every Day Life

(*Continued from page 696*)

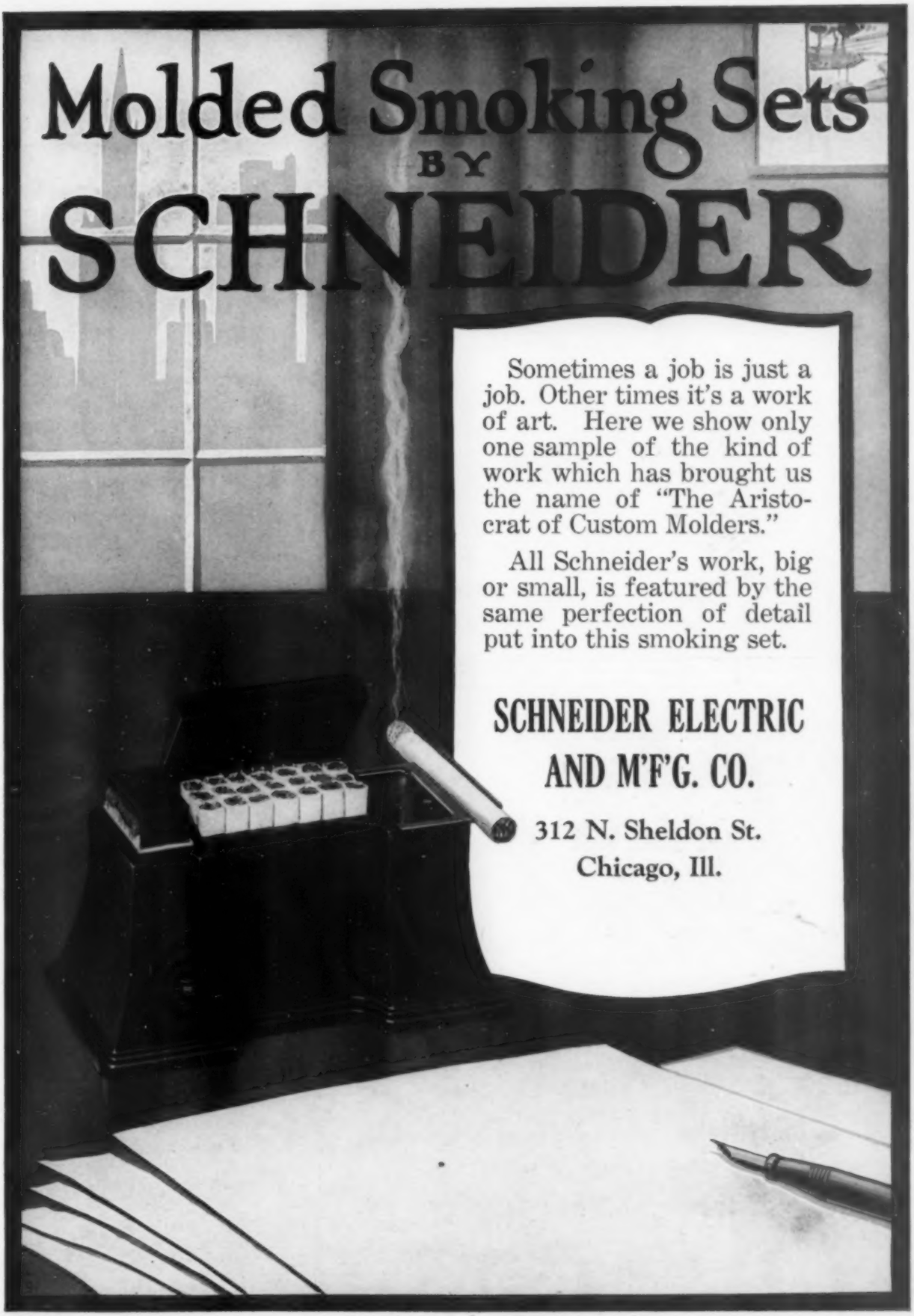
With high school and college behind him, the future business magnate finds himself at his office desk, opens his mail with a composition handled letter opener, adjusts a pyroxylin shade over his eyes, and winds a clock with case molded from phenol resinoid. His ash tray, cigarette holder, writing set and blotter pad, all attest to the convenience and beauty made possible in even the most automatic business routine by pyroxylin plastics.

Wedding bells find the nervous young man in faultless attire, and on his arm leans the lovely bride, her white gown delicately beaded in seed pearls of plastic origin.

And so we might trace every minute stage of man's life on thru the time when spectacles, with their becoming shell rims are necessary, when pyroxylin plastic playing cards while away pleasant hours, and molded chess men move craftily across the chess board, when golf handles are grasped and swung at composition golf balls—on and on, until his earthly activities over, he is laid away to rest in a molded coffin that is lacquer stained and ornamented.

Pocket Lighters

THE body of the pocket lighter depicted in the story "Up to date ideas in lighters" in the October number (page 556) was molded of the resinoid Durez by Modern Molded Products, Inc., Providence, R. I.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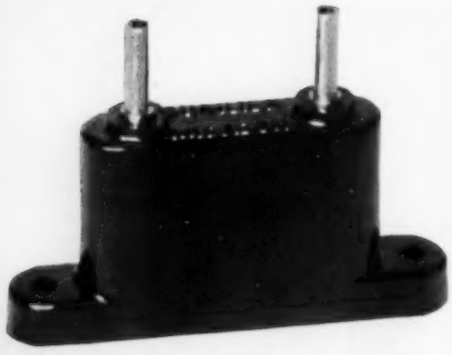

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324 Myrtle Avenue
Boonton, New Jersey

CUSTOM MOLDERS

Molded Products

Engineering Models

(*Continued from page 698*)

like that of which the dam itself was made.

The mercury was in an iron flask from which a strong rubber tube led to a hole in the bottom of the sheet of Celluloid forming the reservoir. The flask was hung on a chain pulley so that it could be raised or lowered at will to fill or empty the reservoir.

Movements of the model under pressure of the mercury were transferred to a dial through a needle carrying a wooden rod. The Tuckerman optical strain gauge served to measure strains at the downstream face of the model. To measure the strains on the upstream face, the relative movements of a pair of needle points connected to adjacent points on the model were observed by means of a microscope.

Silent Gears

(*Continued from page 692*)

the development of the stabilized flexible-web cam-gear, conditions were never better for the installation of a gear-driven timing-mechanism giving the assurance of silent operation and long life.

In the early days of the use of gears made of laminated phenolic condensation material, difficulty was experienced due to the fact that the material expanded in face thickness when first brought into contact with the engine heat. This was a permanent expansion or "set" and was not due to the normal coefficient of expansion of the material. The effect of this was to change the helix angle of the teeth and cause the gears to bind or develop a cross-bearing. For a time it seemed that this tendency to swell would militate against the continued use of the material for timing-gear purposes. However, the

engineers were successful in developing a stabilizing process through a slow heat-treatment which eliminated this difficulty and, today, the increase in face thickness is not more than from 0.0005 to 0.0010 in. per inch of thickness at maximum engine-temperatures.

Imperceptible Wear

The research in connection with this stabilizing treatment developed the fact that, when the helix angle changed materially due to swelling, the teeth of the gears wore to some extent but that, after the blanks had been stabilized and a true rolling-action was attained instead of the twisting action developed by the mating of two gears of different angles, the wear on the gear made of this material was imperceptible after many thousands of miles of service. Inasmuch as the canvas-base material is the grade used in manufacturing timing-gears, our discussion is confined to that grade.

Before the development of the flexible-web cam-gear, it was the practice to saw the blanks from sheets of this material about 36x42 in. in size. These sheets are made by passing the canvas through a bath of resin in liquid form. This liquid penetrates the fabric, which is then passed through a kiln and dried. The fabric is then cut to the desired size and layers are superimposed one on the other until the required thickness is reached. Then the entire mass is placed between plates in an hydraulic press and heat and pressure are applied. The pressure squeezes and holds the fabric as a dense mass while the heat completes the condensation of the resin, causing it to flow and then to harden. The result is a material made tough and strong by the canvas base and bonded together and made oil proof and waterproof and chemically inert by the hardened resin, itself mechanically strong.

The remainder of this story dealing with the properties of these gears will appear in the January number.

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Norton's service and experience in the molding field can help you as a small user with the practical application of molded parts in your own business. It can help you as a large user by its organization equipped to deliver any quantity at any time at the lowest price for work of Norton's quality.
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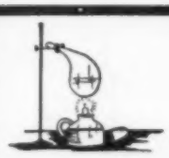

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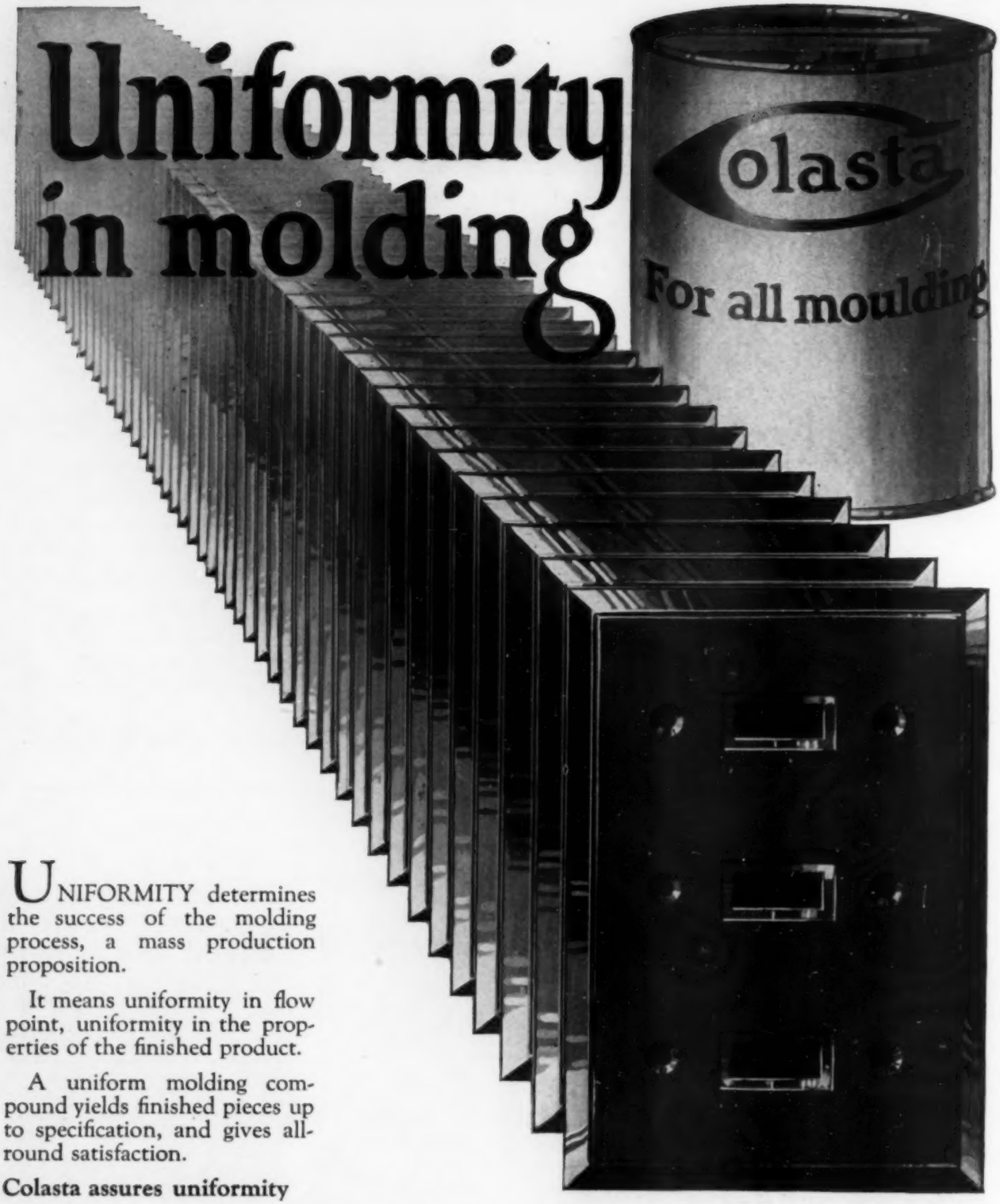

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